UNIVERSITY OF EDUCATION, WINNEBA

EVALUATION OF THE IMPLEMENTATION OF SENIOR HIGH SCHOOL BIOLOGY CURRICULUM IN SOUTH-DAYI DISTRICT OF VOLTA REGION

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DECLARATION

STUDENT'S DECLARATION

I, DANIEL DZOMEKU, declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

SIGNATURE …….

DATE ……

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis as laid down by the University of Education, Winneba.

Name of Supervisor: Dr. James Azure

SIGNATURE …….

DATE ……

DEDICATION

This work is dedicated to the Almighty God who loved me enough to organize in prayer for me and for the harvest of the whole world in Gethsemane until his prayer sweat became great clots of blood dropping upon His seamless garment.

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ABSTRACTS

This study aimed at evaluating the implementation of senior high school biology curriculum in South-Dayi District of Volta Region. The study adopted descriptive survey design using Stufflebeam's CIPP model which involved the evaluation of the Context, Input, Process and the Product aspects of the Programme and Stake's countenance Antecedent Transaction Outcome model. Samples of 10 third year biology teachers were purposively selected from four public secondary schools in South-Dayi District of Volta Region for the study. Four research questions were raised and answered in the study. The instruments developed and deployed for collecting data were: Teachers Questionnaires and observation guidelines on Teacher effectiveness in Classroom Teaching and observation guidelines on physical facilities and resources available in the studied schools that would aid in the implementation of biology curriculum. Frequency count, percentage, mean and standard deviation were the statistics used to analyse the data collected. The study revealed that all the teachers were academically and professionally qualified and experienced to teach biology in the studied schools. The biology teachers were not utilizing the available instructional materials for teaching biology. The common evaluation techniques used by teachers in assessing their students were quizzes and assignments. The teachers were not complying with the recommended teaching methods suggested for use in the biology curriculum. Inadequate laboratory facilities and inadequate number of trained biology teachers were the problems militating against the implementation of the senior high school biology curriculum. In conclusion, the biology curriculum was not well implemented in the study schools. The study recommended, among other things, that government through Ghana Education Service should provide and extend more laboratories, equipment and facilities for science teaching to secondary schools in the District and get more involved in teacher professional development programmes either directly or in partnership with other stakeholders.

CHAPTER ONE

INTRODUCTION

1.0 Overview

The chapter contains information on the background to the study, statement of the problem, the purpose of the study, significance of the study and the research questions addressed by the study. Also presented are the limitations and delimitation of the study. The chapter ends with the description of the organization of the study.

1.1 Background to the Study

According to Marchaim (2001), the importance of biology in the lives of every educated citizen and its increasing eminence in the scientific explosion, behooves professional biologists to provide a challenging scholarly and yet attractive senior high school education both for non-biology and biology students. There have been many proposals for remodeling science teaching in various countries with a wide consensus regarding first, the curriculum, then secondly, the focus was on teaching methods, then thirdly, on making existing courses more rigorous (De Jong, 2000; Hurd, 2000). However, the success of all these changing policies has been less than what was desired. In spite of the intensive call for instructional reform, there has been little actual change (Davis, 2002). The large amounts of money committed to curriculum development and to the production of new materials for the classroom have not brought about major changes in what students learn or how teachers teach (De Rose 1978).

The objectives of the biology curriculum have been adjudged as laudable according to Agu (2006), Soyibo, (2008) and Yabugbe (2009); and there is evidence to show that even though many students find biology interesting, thereby registering for it in the

senior secondary schools, many of them obtain poor results, year in and year out in it as shown by Okebukola and Akinbola, (2008).

For instance, a report from WAEC chief examiner has it that out of 1,100,589 candidates that registered for Biology examination in 2018, only 423,403 41.32%) had credit pass and above. Similarly, in 2019, 2020, and 2021 only 36.36%, 44.06%, and 38.21%, respectively, obtained credit pass and above in Biology. Again, 58.68%, 63.64%, 55.94%, and 61.79%, recorded failure in 2018, 2019, 2020 and 2021 respectively (WAEC, 2018 – 2021). The same trend of poor achievement was reported by South-Dayi District Education Directorate only 43.68%, 39.76%, 46.06% and 40.06% obtained credit and above in Biology in 2018 to 2021, while 56.32%, 60.24, 53.94%, and 59.94%, recorded failure in 2018 to 2021. It is worrisome to note that the biology curriculum being implemented since 1985 still produce students who achieve poorly in biology. This poor performance ought to be empirically investigated rather than speculated upon hence, the need for the evaluation of the implementation of national curriculum for senior high school biology in South-Dayi District of Volta Region.

1.2 Statement of the Problem

The increasing nature of poor academic performance among senior high school students in biology as reported by WAEC and that of South- Dayi District Education Directorate from 2018-2021 (i.e 4years) has been of great concern to many educational stakeholders. Therefore, the problem of this study is to find out to what extent has the implementation of the biology curriculum by implementers' (teachers') succeeded in achieving the set objectives of biology education in the district.

1.3 Purpose of the Study

The purpose of the study was to evaluate the implementation of the SHS biology curriculum and to identify the factors influencing its implementation in South-Dayi District of the Volta Region of Ghana.

1.4 Objectives of the Study

The objectives that guided the study were to:

1. Find out the extent to which teacher characteristics influence curriculum implementation.
2. Find out utilization of resource and adequacy of physical facilities for the implementation of biology curriculum.
3. Identify evaluation techniques used by teachers in assessing their students.
4. Find out the use of instructional strategies suggested in the curriculum.

1.5 Research Questions

In order to achieve the above objectives, the questions below were raised to guide the study:

1. What are teacher characteristics that influence the process of curriculum implementation?
2. How often do the biology teachers utilise the available teaching resources and physical facilities for the implementation of biology curriculum?
3. What evaluation techniques are used by teachers in assessing their students?
4. What are the instructional strategies used by teachers in teaching biology as suggested for in the biology curriculum?

1.6 Significance of the Study

This study will first, contribute to the advancement of knowledge about biology curriculum development in Ghana and the factors that influence implementation of biology curricula programs. Secondly, the study has practical significance because it will lead to improved strategies for implementation of biology curricula procedures and practices by identifying the strengths and weaknesses in implementation. Thirdly, the information generated in the study will be used in establishing a system of information gathering and organization for the purpose of decision making and planning of biology curriculum. Fourthly, the study could be of immediate benefit to the Ministry of Education in Ghana in the formulation of future biology education policy. Lastly, the findings of this study can also form a basis for further research in which the curriculum implementation process is examined and compared in centralized and decentralized education systems.

1.7 Delimitation

The study did not cover the entire Volta Region. The study was limited to only 10 teachers from 4 selected public senior high schools in the South-Dayi District of Volta Region of Ghana. The study focused on the implementation practices of biology teachers.

1.8 Limitation of the Study

Firstly, the survey considered the views of teachers in only one district in the region which might not reveal a general picture about the challenges confronting the implementation of SHS biology curriculum in Volta Region. For a more conclusive result, all the Districts in the Volta Region would have been studied. However, this

was not possible due to financial constraints as University of Education; Winneba does not offer any funds for projects work.

1.9 Organization of the Study

The study is organized into five chapters. Chapter 1 is the introduction outlining the statement of the problem, the purpose of the study, objectives of the study, research questions, and significance of the study, limitation and delimitation of the study. Chapter two dealt with literature review. In this chapter, models of curriculum evaluation, importance of academic and professional qualifications of biology teachers, nature of biology education, importance of biology education, content of SHS syllabus, methods of teaching and learning of biology, challenges facing the teaching and learning of biology, and reasons for low academic achievement in biology was reviewed. Chapter three also indicates a comprehensive description of the methods and techniques that were used in carrying out the study. Also, discussed in this chapter were research design, target population, sample size, sampling techniques, research instruments, data collection and methods that were used to analyse the data. Chapter four of the study dwells on the analysis and discussion of result that were obtained from the research instrument. The last chapter, chapter five considers the summary, conclusion and recommendation of the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter reviews the literature related to the study on the evaluation of the implementation of SHS biology curriculum. The review is presented under the following headings; conceptual framework, theoretical framework, empirical studies and summary of the literature review.

1. **Conceptual Framework**
   - Concepts of curriculum
   - Concept of curriculum evaluation and implementation
   - Teacher quality and roles in curriculum implementation
   - Teacher academic qualification and professional development in curriculum implementation
   - Nature of biology
   - Content of SHS biology syllabus
2. **Theoretical Framework**
   - Stufflebeam (1971) CIPP model
   - Stake's countenance model
3. **Empirical Studies**
   - Studies on the level of compliance of teachers with the recommended teaching methods in the biology curriculum
   - Studies on techniques used by biology teachers in assessing their students
   - Studies on physical facilities and resources for teaching and learning of biology
4. **Summary of Reviewed Literature**

2.1 Conceptual Framework

2.1.1 Concept of curriculum

The word curriculum was coined from the Latin word "currere" meaning "race course", referring to the course of deeds and experiences through which children grow to become mature adults. Curriculum is the set of courses and their contents offered at a school or university. A curriculum is prescriptive and is based on a more general syllabus, which merely specify what topics must be understood, and to what level to achieve a particular grade or standard. That is, a curriculum may be referred to as all courses offered at a school. According to Kelly (2011), "curriculum is all the learning which is planned and guided by the school, p. 112 whether it is carried out in groups or individually, inside or outside the school". In other words, curriculum specifies in advance what we are seeking to achieve and how we are to go about it. He also sees curriculum as a planned leaning experience offered to a learner in school, adding that it is a programme of studies made up of three components programme of studies, programme of activities and programme of guidance.

Hence, the meaning of the term curriculum has also been changed to meet the needs of education of different courses of studies. Blenkin (2000) defines curriculum as a body of knowledge and or subjects. That is, curriculum is the process by which knowledge and skills are transmitted or delivered to learners by the most effective methods that can be devised. Jeffs and Smith (2013) argued that curriculum could be seen in four ways as follows: 1. Curriculum as a body of knowledge to be transmitted; 2. Curriculum as an attempt to achieve certain ends in students; 3. Curriculum as process; 4. Curriculum as praxis. To achieve any of the above-mentioned, effective implementation of a well-planned curriculum cannot be over-stretched.

2.1.2 Concept of evaluation

Evaluation as a concept has been differently defined by different authors. Okunrotifa (2007) defined evaluation as the provision of information involving selection, criteria, collection of data and analysis for the sake of facilitating decision making. In line with this opinion, Ohuche and Akeju, (2007) stated that evaluation undertakes the specification of objectives of some aspects of education and the appraisal of the extent to which the said objectives have been achieved. The authors stated that it strives to give a sound value judgement based on the objectives and criteria as well as informed evidence. The authors outlined the four main objectives of evaluation to be: Giving account of how far the objectives of programs have been achieved, giving guidance as to what step to be taken next.

Evaluation is also seen as an activity that comprises both description and judgement. Theorists that agree with this include Guba and Lincoln (2008), Mkpa (2007 and Onwuka, 2004). Specifically, Onwuka (2004) maintained that the general concept of evaluation could be perceived as frequent decision making and judgements which individuals, groups, institutions and government pass on what affect their lives and others. The author went on to reiterate that such judgements are usually taken on the basis of experience, information evidence or data. Bloom in Ali and Ndubuisi (2006) defined evaluation as making judgement about the value of concepts, methods or materials for some particular purpose.

Evaluation involves the use of criteria and standards to determine the degree to which specific factors achieve accuracy, effectiveness, economy or satisfaction. The author noted that evaluation judgement can be either quantitative or qualitative. Boykin in Ali and Ndubuisi (2006), is of a different view and described the characteristics of

effective evaluation pointing out that evaluation is not merely a testing programme or a synonym for measurement or an administrative device for assessing teaching or instruction; rather, it is a comprehensive cooperatively developed, continuous process of study to be defined and interpreted in terms of its functions and purposes. Bhola (2006) defined evaluation as a process of judging the merit or worth of something.

This is similar to the view of Nworgu (2006) who sees evaluation as used to connote the process of making value judgements of taking decision about events, objects or their characteristics. Nworgu sees it in broader and more encompassing sense as a process of seeking, obtaining and quantifying data with a view of making value judgement about objects, events or their characteristics. A similar view was also expressed by Offorma (2004) that evaluation is the process of finding out the strengths and weaknesses of the whole curriculum endeavour. The author says that it can be regarded as the means of finding out what the students have learnt and what they have not learnt or what gaps remain in their learning to be achieved. The author classified evaluation into two major forms: formative evaluation and summative evaluation. Formative evaluation is the evaluation carried out in the course of a programme so as to determine the extent to which the objectives of the programme are being attained. Summative evaluation is the assessment carried out at the end of the lesson, unit, a terms' work, a year's work or the programme. Elaborating on this Ughamadu (2006) and Onwuka (2004) also classified evaluation into formative and summative. These are usually undertaken during the developmental stage of the programme while the feedback obtained from formative evaluation is used as an input in improving or modifying the programme further before its final adoption. Summative evaluation indicates to the developers of the programme whether the programme developed is effective and useful or not.

2.1.3 Curriculum Implementation

Curriculum implementation entails putting into practice the officially prescribed courses of study, syllabuses and subjects. The process involves helping the learner acquire knowledge or experience. It is important to note that curriculum implementation cannot take place without the learner. The learner is therefore the central figure in the curriculum implementation process. Implementation takes place as the learner acquires the planned or intended experiences, knowledge, skills, ideas and attitudes that are aimed at enabling the same learner to function effectively in a society. Curriculum implementation refers to how teachers deliver instruction and assessment through the use of specified resources provided in a curriculum. Curriculum designs generally provide instructional suggestions, scripts, lesson plans, and assessment options related to a set of objectives. Such designs focus on consistency to help teachers successfully implement and maintain the curricular structure in order to meet various objectives (Wiles & Bondi, 2014).

As noted earlier, Wiles and Bondi defined horizontal alignment as similar instructional practices and curriculum use between teachers in the same grade level, and vertical alignment as similarities in instructional practices and fidelity of curriculum implementation between the previous and following grade levels. Having curriculum alignment between the same grades and the preceding and following grades levels offers consistency in supporting learning objectives and expectations designed to promote student preparedness and growth (Tweedie & Kim, 2015). Understanding the beliefs and concerns of teachers can provide insights into whether curriculum implementation will meet with success or failure. McNeill et al. (2016) and Rakes and Dunn (2015) have all substantiated this notion by addressing the impact of teachers' beliefs about given objectives in science curricula.

McNeill et al. (2016) found that teachers' beliefs significantly influence their decisions for instruction. If beliefs play such a vital role, then taking time to learn about teachers' concerns, values, and perceptions should improve the implementation process by proactively addressing these areas (Al-Shabatat, 2014; Rakes & Dunn, 2015). One of McNeill et al.'s (2016) primary recommendations included preparing teachers through professional development (PD) and collaborative opportunities; specifically, professional development should make sure that teachers fully understand the objectives and receive time to try the new curriculum with a class to support teacher learning. The need for teacher understanding and efficacy when implementing a new curriculum is apparent, especially considering the impact of these factors on student learning. To ensure that curricular innovations are implemented with fidelity, instructional practices should be aligned to the specific learning goals provided in the curriculum (Phillips, Ingrole, Burris, & Tabulda, 2017). Curricular implementation encompasses different components, including the delivery of the curriculum through resources and instructional practices. To implement curricula with fidelity, instructional practices must align with the curriculum as well as support the individual needs of the students (Causarano, 2015). In addition, teacher preparedness for curriculum implementation plays a vital role (McNeill et al., 2016).

Causarano (2015) specifically found this to be true through a study evaluating the quality of math instruction in an urban school and the impact on student-teacher relationships. The findings from their study supported the need for teachers to know the curriculum well to strengthen instructional practices. Content instruction depends on the quality of the explanations the teachers offer (MacDonald et al., 2016). MacDonald et al. (2016) reinforce the need for quality instruction and commitment through their recommendation that PD should help teachers deliver the prescribed

curriculum. Sometimes the problem with implementation results from a problem with the curriculum itself (Caropreso, Haggerty, & Ladenheim, 2016).

Bell (2015) analyzed the advantages and disadvantages of an English grammar curriculum; specifically, the guidance and directives provided to support teachers. Though Bell found the curriculum to be accurate overall, he found that the materials lacked pedagogical guidance to help teachers understand the lessons accurately enough to teach them. Bell pointed out another necessary component when considering the adoption of a new curriculum, but he reinforced how proper training played into implementing the curriculum with confidence (Caropreso et al., 2016; McNeill et al., 2016). Bell found that a lack of training or guidance for curriculum hindered accurate delivery to students. Once again, this type of barrier has been found to influence student growth and learning (Causarano, 2015).

2.1.4 Teacher quality and roles in curriculum implementation

The quality of education depends on teachers as reflected in the performance of their duties. Learners' academic performance in both internal and external examinations has been used to determine excellence in teachers and teaching. Teachers also play a crucial role in educational attainment because the teacher is ultimately responsible for translating policy into action and principles based on practice during interaction with the learners (Afe, 2001). Ineffectiveness of teachers in classroom interaction with the learners could be responsible for the observed poor performance of learners and the widely acclaimed fallen standard of education. Poor academic performance of learners can be linked to poor teachers' performance in terms of accomplishing the teaching tasks, negative attitudes to work and poor teaching habits which have attributed to poor motivation (Akiri & Nkechi, 2009).

Teacher academic preparation, certification type (diploma or degree), and years of teaching experience, among others, are often taken as indicators of teacher quality (Mlambo, 2011). Those teachers with sufficient academic preparation are seen to be competent in the subject matter and pedagogical skills enabling them to be effective in classrooms and produce larger learners' grains (Orleans, 2007). Licensed or certificated teachers are also considered to be effective because licensing typically requires prospective teachers to hold a college degree in pedagogy and in the subject they wish to teach (Orleans, 2007). The roles of teachers remain instrumental in the success or failure of a curriculum (Loflin, 2016).

In many cases, researchers have supported the need to thoroughly understand teachers' roles and concerns during the implementation of a new curriculum (Hall & Hord, 2015). Of the many roles defined in the literature, teacher fidelity stands out as being important but also for being inconsistent among teachers (Loflin, 2016). Jess, Carse, and Keay (2016) found the need to prepare and train teachers to meet the objectives of a curriculum; specifically, the authors' focus was on the curriculum-development process and the role of the educator. Jess et al. (2016) argued that teachers need the capacity to design developmentally appropriate learning tasks that are aligned to curricular expectations. The focus of training and professional development requires an emphasis on teaching how best to interpret the curriculum so that students' needs will be aligned with appropriate instructional practices (Jess et al., 2016). One way to support this situation, as Jess et al. (2016) recommend, includes allowing teachers primary involvement in curriculum development and the process of alignment as it pertains to knowing student needs, and then instructing accordingly. The authors found that understanding how teachers perceive their roles in curriculum

development and implementation provides insight into teachers' concerns about implementing a new curriculum (Jess et al., 2016).

Cho's (2001) findings also show that years of teaching experience affect teachers' view of the value of the curriculum. Therefore, they demonstrate different meanings of fidelity of implementation in their everyday classroom situations. For instance, Cho reports that the novice teacher in the study faithfully used the new curriculum materials based primarily upon the intent of the curriculum developer. What worked best for student learning in her classroom was guaranteeing the right things covered at right times and in an organized manner because the teacher herself felt a need to learn new skills and build on her knowledge for teaching. In contrast, the experienced teacher considered the new curriculum materials to be teaching tools and adaptively used the ideas of the curriculum developer. The critical decisions she made were directly related to her interpretation of students' needs as she perceived them. The history of implementation research shows that planned change attempts rarely succeed as intended (Fullan Steigelbauer, 1991; cited in De Jong, 2000). Smith (1996, cited in De Jong, 2000) reports high failure rates with teachers who must learn new skills while maintaining their daily work schedules and responsibilities.

As Whitaker (1979) asserts, the teachers view their role in curriculum implementation as an autonomous one. They select and decide what to teach from the prescribed syllabus or curriculum. Since implementation takes place through the interaction of the learner and the planned learning opportunities, the role and influence of the teacher in the process is indisputable. You could be thinking, "I understand that teachers are pivotal in the curriculum implementation process, but what is their role in the curriculum planning process?" If the teacher is to be able to translate curriculum

intentions into reality, it is imperative that the teacher understand the curriculum document or syllabus well in order to implement it effectively. If the curriculum is what teachers and students create together, as Wolfson (1997) states in Curriculum Implementations, the teacher must play a more significant role in designing the curriculum. Teachers must be involved in curriculum planning and development so that they can implement and modify the curriculum for the benefit of their learners.

2.1.5 Teacher academic qualification and professional development in Curriculum Implementation

2.1.5.1 Teacher academic qualification

Research conducted by David et al. (2012) suggested that teachers play an important role of an implementer in the classroom. Teachers are recognised as critical factors in the delivery of quality education, and this is why there is a need for improvement in the level of abilities in teachers for them to effectively teach sciences in our schools. The results indicated that if some topics in science were difficult to pupils, it might be the fault of those who present them badly. If the teacher does not have the suitable qualification to offer biology to the grade level she or he is teaching, their difficulties would spill over to the pupils. It is difficult for the pupils to grasp the concepts that the teacher fails to understand. Poorly qualified teachers are very likely to transmit wrong descriptions of observations, misconceptions, misinformation and misapplication of content taught and scientific terminologies. Teacher academic qualification is one of the critical issues in implementing secondary education curriculum. For any programme to be successfully implemented, the implementer must be adequate. It is disheartening to note that in most secondary schools; very few teachers are in existence to the extent that in most cases, teachers are compelled to teach subjects that are not their areas of specialization. For instance, a situation where

a teacher who read Christian Religious Knowledge is allowed to teach English Language biology, one wonders the type of knowledge such a teacher is going to impart to the learners since no teacher teaches what he/she does not know. The question that arises is how can we get adequate number of qualified subject teachers to handle effectively all the subjects meant for secondary education? This need to be looked into for appropriate action because as Offiong (2005) observes the teacher is a major hub around which the success of education revolves. Lassa (2007), therefore, views the teachers as the key to proper development of the child and consequently they are needed in greater number in all the secondary schools. Evidence from studies and research clearly suggests that teachers may be lacking in essential competence areas. The response to this problem has often been to provide more in-service training or provide teachers with further opportunities to either re-train or seek higher teaching qualification (Akyeampong, *et al*, 2009).

2.1.5.2 Teacher professional development

Professional Development offerings are key for supporting teachers in new initiatives (Smit & du Toit, 2016). One benefit of PD includes teachers' increased comfort and skill levels for implementing new curricula. Relevant and effective PD has been found to promote confidence and a greater understanding of objectives (Lia, 2016). Having time and conducting research to develop meaningful PD that will consider the needs, concerns, and experiences of the teacher will be valuable and likely to influence positive growth for the teacher (Lia, 2016). Coldwell (2017) found a connection between teacher confidence and PD. Coldwell (2017) found that PD increased skills knowledge, which enabled teachers' confidence in specific content areas; this in turn led to increased job satisfaction and professional motivation.

A vital point in PD effectiveness includes the influencing factors and concerns that could potentially direct the outcomes of the PD. PD quality, personal motivation, organizational support, and government mandates all fall under areas for teachers' concerns and barriers to implementing a curriculum with fidelity. These factors all influence how teachers respond to PD (Coldwell, 2017). Several studies have found that teacher efficacy stands out as an area supported by effective and relevant PD (Margolis, Durbin, & Doring, 2017). The authors assessed teacher efficacy in integrating new curriculum standards into content areas in classroom teaching. The authors found efficacy to be a primary factor in a teacher's competency level when integrating different content areas into an agriculture curriculum. They recommended ongoing and relevant PD to meet the needs of midcareer teachers. Maintaining teacher confidence and reducing anxiety through deliberate choices in PD content both help to support teachers through curriculum changes (Margolis et al., 2017).

Kyndt, Gijbels, Grosemans, and Donche (2016) explored different types of PD and their related effects on teachers. Kyndt et al. (2016) offer further insight into teachers' attitudes and beliefs as well as the concerns they experience from curriculum implementation through informal learning for professional growth. Teacher collaboration, team planning, or even mentoring may all be classified as informal learning opportunities. Informal learning, though not organized (as formal PD is), allows teachers to work together to reduce the feelings of isolation they often experience (Kyndt et al., 2016). Perhaps most important, as Kyndt et al. (2016) note, is that experience and age do not appear to affect new learning as much as personal attitude does. Understanding the differences in attitudes could help to break down the barriers to full curricular implementation. What this situation shows is that PD does

not always need to be formal; most teachers hope that PD will be relevant to their content areas and will allow them to collaborate and problem-solve.

As the literature has pointed out, understanding teacher concerns helps administrators when choosing the PD that will be most relevant to teachers (Bakir et al., 2016). Bautista et al. substantiated this notion through a study in which they investigated teacher beliefs, priorities, and PD needs when implementing a curriculum. Bautista et al. found that teachers commonly showed eagerness for opportunities to strengthen their expertise in curriculum areas, and they needed PD to do so. Teachers' beliefs also influence their views of the curriculum. For example, if teachers perceive themselves as being unprepared or unfamiliar with a curriculum, then these beliefs will influence how they respond to and teach the curriculum (Bautista et al.,). Bautista et al. recommend that PD should require alignment with teachers' learning demands to achieve optimal effectiveness. Professional development plays a part in reducing anxiety when implementing a new curriculum (Hall, 2015). Cetin (2016) found similar conclusions as Bautista et al. (2016) regarding the benefits of PD. Cetin (2016) included an increased understanding of science teachers' level of use for technology integration and the effect of PD sessions designed to improve comfort and proficiency. The teachers initially showed little knowledge on the subject area and a lack of training and skills necessary for successful integration. Cetin (2016) reported that following the PD sessions for technology, 58.5% of the teachers developed increased confidence and positive outlooks about the integration process.

Cetin's study (2016) provides a concrete example of how PD improves teacher proficiency as well as alleviates concerns through the practical application of the curriculum. Teachers become more likely to implement curricula with fidelity when

they feel well prepared through PD and develop the knowledge and awareness required for effective implementation (Cetin, 2016). Supporting the need for PD and for understanding the concerns connected to a new curriculum implementation, Bandura's (1977) social learning theory emphasizes the importance of monitoring and modeling behaviors, attitudes, and emotional responses for a desired result. Bandura's (1977) theory connects to the CBAM because of the value it places on understanding emotional responses identified through the stages of concern. The importance of PD and the effect on teachers both align with the theory by directing attention to proper training for increased success in accurate curricular implementation.

2.1.6 Nature of biology

There has been consistent decline in the performance of students in public examinations conducted by the west African Examination Council (WAEC) and the National Examination Council (NECO) in sciences across the country over the years (Agogo, 2003; Samba & Eriba, 2012). Ahmed and Abimbola (2011) argue that because of its numerous importance's, biology is the most popular choice, among science subjects nationwide, offered by candidates sitting for the senior secondary school certificate examinations. According to WAEC Research Report (2008; 2009), despite the popularity of Biology, results of research studies always revealed the poor performance of students in the subject. There are many reasons why students have difficulties in learning biological concepts (Lazarowitz and Penso, 1992; Tekkaya et al., 2001; Çimer, 2004; Zeidan, 2010). The nature of science itself and its teaching methods are among the reasons for the difficulties in learning science, while according to Lazarowitz and Penso (1992), the biological level of organization and the abstract level of the concepts make learning biology difficult. Overloaded biology

curricula, the abstract and interdisciplinary nature of biological concepts, and difficulties with the textbooks are the other factors preventing students from learning biology effectively (Chiapetta and Fillman, 1998; Tekkaya et al., 2001). Chiepetta & Fillman (1998) state that overloaded biology curricula may not contribute to students' achievement and lead them to learn the material through memorization. This, of course, prevents meaningful learning.

2.1.7 Content of SHS biology curriculum

In the development of biology education in Ghana, the relevance of biology education curricular cannot be ignored. The current biology syllabus in Ghana is an improvement and a reorganization of the one introduced in 1987 as a result of the New Educational Reforms. The focus of the new form of teaching and learning of biology as indicated in the syllabus, is to move teaching and learning from didactic acquisition of knowledge and rote memorization to a new position where students will be able to apply their knowledge, develop analytical thinking skills, develop plans, generate new and creative ideas and solutions and use their knowledge in a variety of ways to solve problems. According to the Curriculum Research and Development Division (CRDD, 2010), the rationale for the teaching of biology ultimately must be to explain the living world in terms of scientific principles. It is also to guide and inculcate in the learner skills in observing and measuring, formulating hypothesis, predicting and designing, investigating, recording data and interpreting results, drawing conclusion and communicating them.

The content of the syllabus has been designed in such a way as to provide students with basic knowledge in biology for them to understand themselves and other organisms, which will enable them, make very informed choices as they interact with

nature. The scope of the content also enables the learner pursue specialized careers relating to biology and fully prepares the students who wish to continue the study of biology at the tertiary level. It furthermore provides the aims, the purpose and the principles of the curriculum.

The aims and purposes of the biology curriculum commit to social transformation, progression, critical thinking, inclusivity, the value and awareness of indigenous knowledge systems, and to credibility, quality and efficiency (CRDD, 2010). A challenge, however, exists when it comes to addressing some of the curriculum aims. Lelliot (2014:320) indicates that the curriculum is not played out in the classroom as it was envisaged by the developers. Firstly, the content deals more with theory than with investigations, and the examinations weigh more than school-based assessments (Ladwig, 2009:280; Lelliot, 2014). This means that the teacher will spend more time teaching scientific knowledge rather than teaching scientific process skills, and doing practical investigations with learners (UNESCO, 2010). Inability to do practical investigation results in the curriculum being unable to achieve it aim of teaching learners critical thinking skills this results in students being unable to use the inductive process of observing the natural world and drawing conclusions.

Indeed, the document outlines diverse examples of investigations that could be done with each topic but teachers end up not doing the prescribed practical investigations because they weigh less when it comes to assessments (Moodley, 2013). Secondly the curriculum does not explain which indigenous knowledge is to be taught; the curriculum needs to give specific examples of the indigenous knowledge to be taught.

2.2 Theoretical Framework

2.2.1 Stufflebeam (1971) CIPP model

The evaluation adopted the CIPP (Context, input, process and product) model developed by Stufflebeam (1971). The context variables include students' characteristics, teachers' characteristics, qualification and experience. The input variable is adequacy of laboratory facilities while process variable is classroom teaching effectiveness. The product variables are students' achievement and attitude towards biology. Stufflebeam (1971), who chaired the Phi Delta Kappa National Study Committee on Evaluation, introduced a widely cited model of evaluation known as the CIPP (context, input, process and product) model. The approach when applied to education, aims to determine if a particular educational effort has resulted in a positive change in school, college, university or training organisation.

A major aspect of the Stufflebeam‟s model is centered on decision making or an act of making up one's mind about the programme introduced. For evaluations to be done correctly and aid in the decision making process, curriculum evaluators have to: (i) First, delineate what is to be evaluated and determine what information that has to be collected (eg. how effective has the new biology programme been enhancing the scientific thinking skills of children in the secondary schools) (ii) Second, obtain or collect the information using selected techniques and methods (eg., interview teachers, collect test scores of students); (iii) Third, provide or make available the information (in the form of tables, graphs) to interested parties. To decide whether to maintain, modify or eliminate the new curriculum or programme, information is obtained by conducting the following 4 types of evaluation: context, input, process and product. Stufflebeam‟s model of evaluation relies on both formative and

summative evaluation to determine the overall effectiveness of a curriculum programme.

(a) Context Evaluation (What should be done and in what context)? This is the most basic kind of evaluation with the purpose of providing a rationale for the objectives. The evaluator defines the environment in which the curriculum is implemented, which could be a classroom, school or training department. The evaluator determines needs that were not met and reasons why the needs were not being met. Goals and objectives are specified on the basis of context evaluation. In other words, the evaluator determines the background in which the biology curriculum is being implemented. The techniques of data collection would include observation of conditions in the school, background statistics of teachers and interviews with players that are involved in implementation of the curriculum.

(b) Input Evaluation (How should it be done?) The purpose of this type of evaluation is to provide information for determining how to utilize resources to achieve objectives of the curriculum. The resources of the school and various designs for carrying out the curriculum are considered. At this stage, the evaluator decides on procedures to be used. Unfortunately, methods for input evaluation are lacking in the Ghanaian educational system. The prevalent practices include committee deliberations, appeal to the professional literature, the employment of consultants and pilot experimental projects.

(c) Process Evaluation (Is it being done?) This is the provision of periodic feedback while the curriculum is being implemented. This is geared to fully understanding how a programme works – how does it produce that results that it does? This evaluation is useful if programme is long-standing and have changed over the years, employees or

customers report a large number of complaints about the programme, there appear to be large inefficiencies in delivering programme services and it is also, useful for accurate portraying to outside parties how a programme truly operates.

(d) Product Evaluation (Did it succeed?) or outcomes of the initiative. In this type, the data is collected to determine whether the curriculum managed to accomplish what it sets out to achieve (e.g. to what extent students have developed more positive attitudes towards biology). Product evaluation involves measuring the achievement of objectives, interpreting the data and providing with information that will enable them to decide whether to continue, terminate or modify the new curriculum. For example, product evaluation might reveal that students have become more interested in biology and are more positive towards the subject after introduction of the new science curriculum. Based on these findings the decision may be made to implement the programme throughout the country. (See Figure 1) Evaluation is required at all levels of the programme implemented.

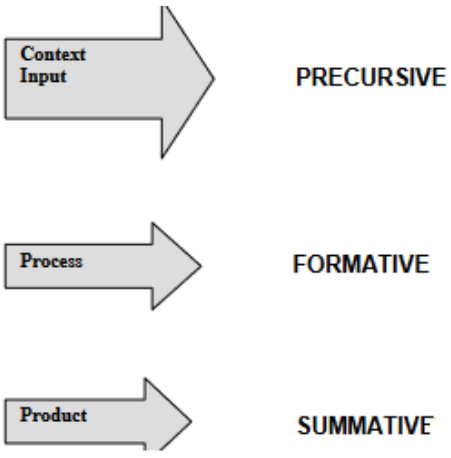

Figure 1: Percussive, Formative and Summative Evaluation in the CIPP Model

Sources: Adapted from Ornstein, A. C. and Hunkins, F. P. 2004.

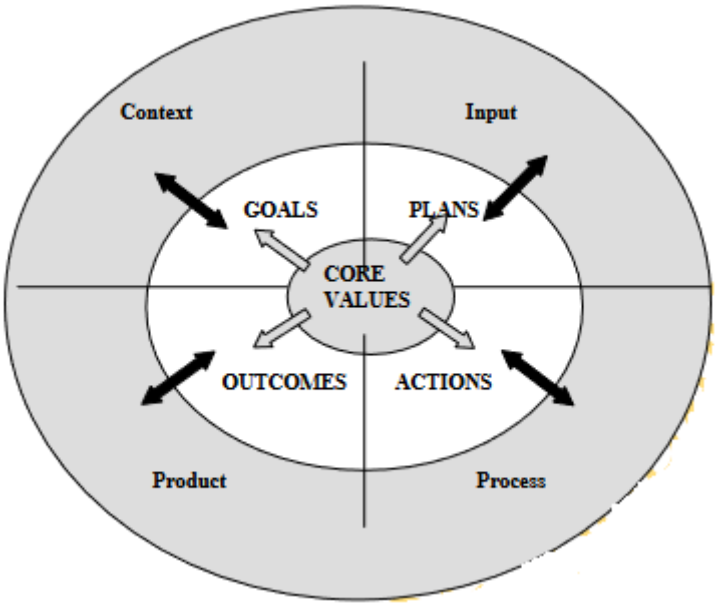

Figure 2: Context, Input, Process, Product Model

Source: Adopted from Ornstein, A. C. and Hunkins, F. P. 2004.

2.2.2 Stake's countenance model

The model was proposed by Robert Stake (1967) which suggests three phases of curriculum evaluation: the antecedent phase, the transaction phase and the outcome phase. The antecedent phase includes conditions existing prior to instruction that may relate to outcomes. The transaction phase constitutes the process of instruction while the outcome phase relates to the effects of the programme. Stake emphasises two operations; descriptions and judgements. Descriptions are divided according to whether they refer to what was intended or what actually was observed. Judgements are separated according to whether they refer to standards used in arriving at the judgements or to the actual judgements.

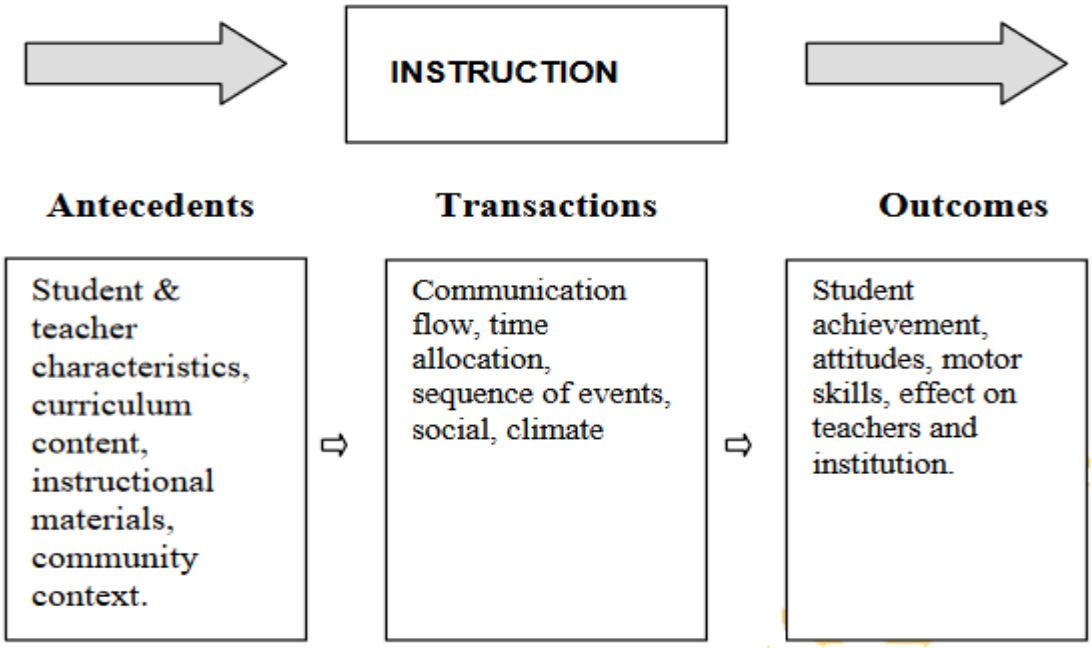

Figure 3: Stake"s Countenance Model

Source: Adopted from Ornstein, A. C. and Hunkins, F. P. 2004.

2.3 Empirical Studies

2.3.1 Studies on the level of compliance of teachers with the recommended teaching methods in the biology curriculum

Most of the teachers think that they can improve their teaching practices through developing sound knowledge of content that needs to be taught and delivered (Hill and Crevola, 2003). This is a major drawback in many schools. The teachers lose focus on their teaching strategies and they assume that the learners face difficulties because the content (what needs to be taught and delivered) is complicated or not of their interest, instead of realizing the fact that the teaching strategy (how to teach and deliver) should be more effective and as per their requirement and needs in order to generate their interest and better learning opportunity for the students. The primary purpose of teaching at any level of education is to bring a fundamental change in the learner (Tebabal & Kahssay, 2011). To facilitate the process of knowledge

transmission, teachers should apply appropriate teaching methods that best suit specific objectives and level exit outcomes.

Studies have shown that there is a relationship between teaching methods and students. Performance as for example has been found that teachers who used a specific style of evidence-based teaching and operate within a developmental learning paradigm had an increase effect on student learning outcome (Griffin, 2007) thus teaching methods play an important role in producing good students' performance. Furthermore, several studies conducted on teaching methods in many parts of the world Haas, (2002), Asikia, (2010), Bategeka, Luntungan, (2012) have demonstrated that teaching methods impact students' performance. These studies clearly indicate that teaching methods used by the teacher have an impact on students' performance and medium of instruction also impacts on students' performance (Senkoro, 2004 and Canton, 2007). It is often said that lesson itself is not interesting; in fact, it is teacher who makes the lesson enjoyable using various teaching methods that fascinate the students. Teaching methods used in the class have imperative role in learning and producing skilled and knowledgeable students. Teaching methods are used to impart knowledge to students, they are the means by which the teacher attempts to impart the desired learning or experience (Ndirangu, 2007). The choice of a particular method of teaching by the teacher determined by number of factors which includes the content to be taught, the objectives which the teacher plans to achieve, availability of teaching and learning resources and the ability and willingness of the teacher to improvise if convectional teaching aids are not available, evaluation and follow-up activities and Individual learner differences (Ndirangu, 2007).

Teaching according to Okonkwo (2005) is a deliberate effort by a mature or experienced person to impart information, knowledge, values skills, norms (standard behaviour) more (moral values) attitude, language and so on to an immature or less experienced person through the process that is morally and pedagogically acceptable. According to Oforkansi (2008), method is a way in which you organize and present learning materials to pupils/student. Method of teaching has a great role to play in teaching learning process and it contribute a lot for effective teaching and learning. (Jonassan, 2006) states that pedagogy is a different way teacher can teach. Teaching methods has been defined as in different ways depending on the philosophical situation taken by the researcher as discussed here under; Kimweri (2004) teaching method refers to variety ways in which a learning task is managed to facilitate the learning process. This means the way of organizing the participants and the type of methods to be used will be determined by different factors i.e. number of students, age and the topic to be taught. Teaching methods is the means or strategies employed by the teachers in attempt to impart knowledge to the learners (Asikhia 2010). It also defined as the strategy or plans that outline the approach that teachers intend to take in order to achieve the desirable objectives (Osokoye, 1996). The teaching method is determined according to the nature of the contents. There can be three methods of the content.

There can be three methods of presentation. Such as:

1. Telling Method: Lecturing, questioning etc.
2. Doing Method: Project method
3. Showing Method: Demonstration, observation etc.

Shield (2002) pointed out that good teachers follow no one method; instead, he/she uses whatever method and materials that seem to be best for the particular combination of individual situation. Various studies had been conducted concerning teaching methods, for example Asikhia (2010) found that, qualification of teachers and students' environment factors do not influence student's poor performance but teachers' methods of teaching influence poor academic performance. The commonly used teaching methods especially in developing countries are teacher centered (Guloba, Wokodola, & Bategeka, 2010), which are viewed to be somewhat ineffective in the impartation of knowledge.

In order for the method used for teaching to be effective, Adunola (2011) maintains that teachers need to be conversant with numerous teaching strategies that take recognition of the magnitude of complexity of the concepts to be covered. There are two categories of teaching method namely, teacher-centred method and learner-centred methods of teaching (MIE, 2004). Learner-centered instruction refers to the students' constructing their own understanding of content; develop a personal feeling that the knowledge is their own (Jacobson Kauchak, 2009). A single method cannot meet all of our goals nor can a single method accommodate all learning styles at once. For example, demonstrations or projects are effective for meeting some goals but ineffective for meeting others. So, for effective teaching and learning of biology, we need a toolbox of methods, not merely a single tool. Therefore, student centeredness implies the heavy emphasis on enquiry and problem-based learning involves on making student as the center point of learning and group work. Each of this method is discussed in detail below: For the purpose of this study, nine (9) of the biology teaching and learning methods shall be discussed.

2.3.2 Fieldwork in the teaching and learning of biology

Baker, Slinngby and Tilling (2002) argue that fieldwork in the teaching of biology is found to be very advantageous to both learners and teachers in various ways.

1. Biology as a discipline has its roots in fieldwork in natural history. It is used as an essential tool to observe, collect and process data on species and habitats.
2. Provide an excellent opportunity for learners to work as a team.
3. Biology fieldwork provides one of the places in science curriculum where learners quite literally observe the real world and use it as a basis for scientific inquiry.
4. Outdoor biological teaching introduces learners to unfamiliar environment, which they may not otherwise see; hence they are able to see the natural world which is remote from their everyday lives.
5. Ecological fieldwork where living animals and plants are encountered in real habitats can help to put fun and enjoyment back into a content dominated curriculum.

2.3.3 Question and answers (citation) method

Question and answers defined as a method both for teaching and oral testing based on the use of questions to be answered by the student (Mtunda & Safuli, 1997) in (MIE, 2004) Questioning techniques is one of the basic and successful ways of stimulating students thinking and learning (Ndirangu, 2007) it is applicable to all teaching approaches and methods.

2.3.4 Discussion method

Discussion method is an important component for any teaching or learning situation which allows students to share their ideas (Ndirangu, 2007). It can be used at the beginning of a topic to ascertain students' pre -conceived notion of the subject matter

or toward the end of a sub - topic by presenting student with a new situation and asking them to explain it in terms of what they have just learned. Discussion group method entails a teaching and learning strategy through sharing and exchange of ideas, experience and opinion takes place, accompanied by active learning with all member of the group participating in it (Kimweri, 2004). Strengths of discussion method are; increases the depth of understanding and grasp of the subject matter, enhances motivation and generates greater involvement of the learners, promotes leadership role skills, develops skills of organizing and presenting ideas to others in a logical form and develops a spirit of cooperation among learners. In spite of the strengths there is also limitations of discussion method which includes time consuming, can be used effectively with a limited number of learners, if not well handled some extrovert learners may dominate the discussion.

2.3.5 Brainstorming

Brainstorming is a teaching technique in which every student response that applies to a given topic is acceptable (MIE, 2004). The strengths of brainstorming helps promotes exploration, analysis and problem-solving skills, develop the sense of cooperation and group cohesiveness in problem solving, encourages the generation of creative ideas, promotes the generation of initiatives in searching solutions to problems. The limitations of brainstorming are; it is time consuming if not planned, more useful to a limited number of learners and need thorough preparation.

2.3.6 Demonstration method

Another method of teaching Science is the Demonstration Method. Enemali (2006) described this method of instruction as a showing procedure, to explain, teach and inform students, while Arubayi (2009) described demonstration method as a visible

presentation of ideas, skills, attitudes, processes and other intangibles. Demonstration is a practical display or exhibition of a process and services to show or point out clearly the fundamental principles or actions involved (Kimweri, 2004). Teaching by demonstration is a useful tool available to teacher and plays an important part in the teaching of skills; however, for a demonstration to be effective it should immediately be followed with a practical session in order to reinforce procedures (Kimweri, 2004). The strengths of demonstration include learners get the actual experience of what they are learning and interesting to learners and thus promote their attention and retention. The limitations of the demonstration method are; time consuming and expensive, needs thorough preparation in practice and rehearse before the session, enough teaching and materials are required to successfully conduct a demonstration, it is more appealing when used with a group that has a limited number of learners. Other methods of teaching are role play method, case study, buzz group, and field trips.

2.3.7 Cooperative learning

Cooperative learning is another teaching method that is considered highly effective when done correctly. With cooperative learning, students are put in small groups to work together. They are usually not grouped by ability, but put in a group with student at a variety of levels. The students are then given tasks to accomplish together. Teachers may need to monitor these groups carefully, to make sure they are staying on task and that all students are participating. This form of instruction also lends itself well to differentiation, because the teacher can assign specific tasks to children at different ability levels. (http://www.wisegeek.com).

2.3.8 Lecture method

Lecture is one way of communication where teacher talks to students in an autocratic way and in its pure form, the student has no opportunity to ask questions or offer comments during the lesson (MIE, 2004). The strengths of a lecture method are, it is useful when introducing new subject matter or presenting over view summaries to student, it can be used for teaching group of any size and the teacher to cover a lot of content in short space of time. Despite of strengths of lecture method it has limitations, it does not take into account the individual needs, feeling or interest of students, no feedback from students is required, if not properly planned can led to boredom, it is difficult to assess whether or not learning through lecture is poor and to what extent, the quality of learning through lecture is poor and not permanent finally, the teacher spend a lot of time preparing detailed notes which are rarely learned by the student.

2.3.9 Inquiry-based learning

Inquiry-based learning is a teaching method which is rapidly gaining popularity in schools all over the world. Based on the scientific method, this teaching method can be used for virtually all subjects. This teaching method is extremely student-centered and student-directed, and can be modified for students at any level, reaching them where they are. Teachers will generally need to start by modeling the process to the students. Inquiry-based learning is the driver of the complex thinking during the problem-solving processes (Barell, 2010) and IBL depends on the students' prior knowledge to construct new knowledge by themselves (Barrow, 2006). The current biology curriculum developed by Curriculum Research and Development Division (CRDD) of the Ghana Education Service (2010) encourages the use of this approach. The CRDD (2010) defined scientific enquiry as a combination of practical and

experimental skills that one needs to develop to become a good biologist. It deals with the understanding of the nature of science. It requires the constant asking of questions about how and why things happen the way they do. Scientific enquiry is crucial for defining the characteristics of scientifically literate persons (Ogunmade, 2005)

2.3.10 Laboratory method

Arubayi (2009) opined that, the laboratory method of teaching comprised of variety of activities ranging from the experimental investigations to confirmatory exercises and skill learning. Arubayi summarized the major objectives sought in laboratory work, as the development of skills, concepts, cognitive abilities and understanding of the nature of Science. Skills such as manipulative, inquiry, investigation, organizational and communicative, can be developed from laboratory experiences**.**

2.3.11 Studies on techniques used by biology teachers in assessing their students

The Education Commission (2000) defines assessment as collecting evidence of the learner's learning. It is an integral part of the learning and teaching cycle rather than a separate stage at the end of teaching. It helps to provide information for both learners and teachers to improve learning and teaching. Continuous assessment could be internal (school assessments such as tests, homework and projects) or external (example of assessment is mock examinations). The aim of internal assessment is to provide information to students and parents about the performance of students. External assessment provides information to education department and ministry officials about what is happening in schools. Continuous assessment also called formative assessment has been described as the type of assessment whereby the learners are evaluated throughout the year of their course of study (Amedahe, 2000;

Etsay, 1992). It enables teachers to get quick information about the student's progress which helps to evaluate their teaching strategies.

Webb and Brairs (1990) see continuous assessment as an interaction between teachers and learners. This implies, teachers continually find out what learners can do and how. Lewis (1997) observes that many countries have adopted continuous assessment strategies in order to improve the quality of teaching. In Nepal, Carnoy (1999) notes that continuous assessment is used as an indicator of school quality and for learner promotion purposes. Etienne (2007) observes that in Mauritius, some teachers practice continuous assessment at the beginning of the first term for purely organizational reasons. However, on the African continent, practices of continuous assessment vary from country to another. In Liberia, for example, continuous assessment is weighted 65% and the final examination 35 % (Wisseh, 2009). In Nigeria, continuous assessment started in 1977. It was aimed at assessing overall progress of learner performance and teacher use of different strategies. The continuous assessment weight is 60% and the final examination weight is 40% (Pennycuick, 1990). In Swaziland, continuous assessment was implemented in 1996 with the aim of evaluating whether learners understand the content taught in the classroom (Fakudze, Simelane and Dlamini, 1979). Amedahe (2000) reports that, in Ghana continuous assessment was introduced into secondary schools after the New Education Reforms Package of the late 1980s. In Ghana, continuous assessment is criterion referenced and focuses on whether learners understand concepts (Etsey, 1992). The study indicated that science and for that matter biology is being assessed theoretically. Even the experiments are done theoretically. This means that learners do not interact with the scientific material and are not allowed to discover the concepts by themselves. They do not do experiments. This means that science loses it exciting

nature, and hence bores the learners (Muzah, 2011). Berliner and his colleagues (e.g., Nichols & Berliner, 2007) have argued that the high-stakes testing that is required as part of NCLB is detrimental to education in many ways. The cognitive strategies and motivational beliefs that students employ are largely determined by how they are assessed (Paris, Lawton, & Turner, 1992).

2.3.12 Studies on Physical Facilities and Resources for Teaching and Learning of Biology

Muriithi et al (2004) from their paper on resources and facilities for teaching and learning of biology defines a resource as any source of information or support that the teacher uses to make teaching more effective and meaningful to the learner. A facility provides the teacher with the conducive environment in which to carry out effecting teaching. Due to the nature of the current overloaded curriculum, teachers tend to concentrate on giving information to their students. According to Amanuel (2009), facilities include laboratory, botanical garden, aquarium, vivarium, school museum, green house, darkroom and national parks. A Laboratory is an instructional facility for an effective science programme where development of scientific skills and attitudes are greatly facilitated. It's an important facility in a school and if present it should be well equipped with facilities that would enhance the teaching/learning of Biology i.e. with enough water, drainage system, ventilations, furniture, fire extinguisher, prep room fume chamber, emergency door, chalkboard/Duster/chalk, storage room, source of heat, basic reagents and lab coats The challenge of a lack of resources in schools is a matter of concern worldwide.

The lack of resources, such as textbooks, physical infrastructure and laboratory equipment has led to the learners losing interest in the subject, and hence poor

performance (Mwenda et al., 2013:98; Muwanga-Zake, 2000; Makgato & Mji, 2006; Amukowa, 2013:105; Mwaba, 2011:33). The above statement is supported by the findings of Onwu (1999) where he compared schools with resources with schools with no resources, and found that schools that lacked resources performed poorly. The lack of resources leads to a failure to enhance effective learning, as the subject then only remains taught in theory (Makgato, 2007:91; Dhurumraj, 2013:51). It also limits written work as the teachers cannot give homework because the learners share books (Onwu, 1999). Muzah (2011:192), Makgato (2007:96), and Dhurumraj (2013) believe that the availability of practical lessons clarifies and reinforces scientific concepts. It further enhances the learner's interest in science, increases their manipulative skills and memory of the content, makes the subject relevant, helps learners to acquire skills, it promotes discipline, and also assists them in solving problems. However, the subject remains to be teacher-centered, and instructed in a talk-and-chalk method which bores and demotivates the students (Onwu, 1999; Lebata, 2014:80). Therefore, research indicates that for the effective teaching and learning of science adequate and relevant resources need to be available, as they make up an essential component (Dhurumraj, 2013:49). Yara and Otieno (2010:126) indicate that the availability of teaching resources enhances the effectiveness of the schools as they can bring about good academic performance in the students.

2.4 Summary of Reviewed Literature

Evaluation has been defined in various ways by different scholars who emphasized different aspect of the process of the definitions. However, there are certain points similar to all the definitions of evaluation. These include that: evaluations is a process, evaluation involves identifying, obtaining and providing information (data); the information collected must be based on the stated objectives of the programme to be

evaluated; and such information is made available to decision-maker, who makes decision as regards the programme evaluation. The new trend towards a more comprehensive approach to curriculum definition viewed curriculum in terms of major components.

The order to be followed for a more dynamically conceived and placed curriculum includes: diagnosis of need; formulation of content; selection of content; organization of learning experiences; and determination of what to evaluate and the ways and means of doing it. The development and recommendation of a number of models as guides for carrying out process of evaluation was variously viewed. However, all the models, especially Stufflebeam (1971) model advocates step by step approach and also emphasized attention to stated goals and objectives and that every aspect of whatever is being evaluated should be taken into consideration.

Attention has been given to related studies on the extent to which the aims and objectives of the national curriculum for secondary school biology contents have been achieved; extent to which the contents of the biology curriculum for secondary schools cover the aims and objectives of the curriculum; the rate at which biology teachers utilize the available input factors such as teaching equipment and materials; (chemicals, specimens) and other teaching support facilities; level of compliance of teachers with the recommended teaching methods as indicated in the biology curriculum; the evaluation techniques used by biology teachers in assessing their students.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter presents the research methodology that guided the study. The sections included are research approach, research design, the area of the study, the population sample, sampling techniques, data collection methods and instruments, validation and reliability of instruments, the data analysis plan, and issues relating to the ethics in conducting this particular study.

3.1 Research Design

The study was based on descriptive survey design. According to Omari (2011), descriptive survey design is very analytical, conceptual and inferential which describes existing conditions and comparing groups of respondents. Therefore, in this study descriptive survey was used to gather and analyse data.

3.2 Population

Population is any group of individuals who have one or more characteristics in common that are of interest to the researcher from which one can collect data for the study (Kothari, 2004). The target population for this study consisted of all biology teachers' in all the four public senior high schools in South-Dayi district. Accessible population comprised all third year biology teachers in all the four selected public senior high schools in the district.

3.3 Sampling Technique

Kothari (2004) maintains that, sampling technique is a procedure that the researcher adopts to select items for the sample. It is the process of selecting a sample from the target population to represent the population in the study. The sampling technique that was used in this study was purposive sampling. The technique was used to select all third-year biology teachers to complete the questionnaires. Four schools were purposively selected for observation on availability of instructional, physical structures and facilities available for teaching and learning of biology. All the third-year biology teachers' from the four sampled schools were purposively selected for observation on biology instructional strategies in biology lessons.

3.4 Sample

The sample for the study was drawn from four senior high schools in the study area namely: Peki Senior High Technical School, Peki Senior High School, Kpeve Senior High Technical School, and Tongor Senior High School in South-Dayi District of Volta Region. The sample for the study consist 10 third-year biology teachers.

3.5 Research Instrument

Two research instruments were developed for the study. They are:

1. Questionnaire
2. Observation Guide

3.5.1 Questionnaire

The questionnaire consisted three parts. In the first part, teacher characteristics were asked to collect general information about teachers on sex, age, years of teaching, academic qualification, professional qualification, area of specialization, and

attendance of in-service training programme. The second part includes questions designed to find out the rate of use of instructional materials and availability of physical facilities by teachers during biology classes. The third part includes questions on evaluation techniques used in assessing students. The last part includes questions design to find out instructional strategies used by teachers in their biology classes.

3.5.2 Observation guide

Observation was carried out on biology classroom teaching to observe lesson features such as instructional behavior of teachers, methodology used by teachers in biology lessons and students' engagement in biology lessons. Observation was also carried out to find out adequacy of biology laboratories and library for teaching and learning of biology in the studied schools.

3.6. Reliability of Questionnaire

To determine the reliability of the questionnaires for this study, teachers 'questionnaire was pilot tested in four schools. Reliabilities of teacher's questionnaire was determined using Cronbach's-Alpha to be 0.83.To ensure data reliability of observation on resources, physical facilities and class room observation check list was used.

3.7. Validity of Instrument

Content validity of the two instruments was determined and validated with the help of experts and supervisor of the project. The questionnaires were submitted to a group of six experts in the field of Curriculum and Instruction and Biology Education for an assessment of content validity. After making the necessary amendments based on the expert's and supervisor's constructive criticisms, the content validity of the instrument was established and all the items are positive devoid of any unambiguity.

3.8 Data Collection Procedure

The method of data collection involved a combination of extensive direct observation as well as use of questionnaire. The data collection exercise was undertaken over a period of one month (30 working days). With the letter of introduction from the Head of Department, the researcher visited the sampled schools in person, negotiated with the school authorities before administering the questionnaires on the teachers. The researcher administered the questionnaires to the teachers on different date and days. Much ample time was given them to answer the questionnaire items before retrieval. In the next phase of data gathering, the researcher checked the observation guide on physical structures and facilities of the schools appropriate for the biology curriculum to be implemented in the way it is intended. The third phase of data collection was biology classroom observation of teacher effectiveness during biology lessons.

3.9 Data Analysis

Data from the questionnaire and observation on physical facilities were analysed using descriptive statistics. Cohen and Morris (2008) recommend this and stated that numeric data analysis can easily be performed using software packages such as SPSS, Minitab or Excel. The raw data was edited to improve its quality of coding. Editing involved condensing the large amounts of field data into few manageable groups and tables and analyzed into statistical package for social sciences, SPSS version 22.

3.10 Ethical and Logistical Considerations

Special emphasis was laid on confidentiality and anonymity of participants in case of sensitive or gazette data and their consent to participate in the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Introduction

This chapter presents the findings and discussions of the study as per the data collected through teachers' questionnaires and the researcher's observation guideline. Results from data analysis of questionnaire are presented first followed by researcher's observations. The results of the study are presented in line with the research questions that guided the study.

4.1 Research Question One: What are teacher characteristics that influence the process of curriculum implementation?

The following characteristics of students and teachers were looked at.

a. Teacher characteristics: sex, age, teaching experienced, qualifications, area of specialization and in-service training.

4.1.1. Teachers Characteristics

Teacher characteristics are covered in Tables 1

4.1.2 Teachers' Gender and Age

The study sought the distribution according to the gender of teachers in order to find out the representation of both sexes (female or male) in the study. The study also determined the teachers' age. Data obtained from the field regarding teachers' gender and ages are presented in Table 1 to 8.

Sex distributions of teachers are presented in Table 1:

Table 1: Sex Distribution of Teachers

Sex	**Freq.**	**%**
Male	6	60
Female	4	40
Total	**10**	**100**

Source: Field data, 2022.

Out of the 10 teachers sampled, only six (60%) were males and the remaining four (40%) constituted females.

The age distribution of teachers was also examined as shown in Table 2.

Table 2: Age Distribution of Teachers

Age	**Freq.**	**%**
21-30yrs	0	0
31-40yrs	6	60
41-50yrs	3	30
51-60yrs	1	10
Total	**4**	**100**

Source: Field data, 2022.

The majority of teachers ranged from 31 - 40 years representing 60% of the total sampled. Few of them were between the ages of 41 - 50 years representing 30%. Only one teacher was above 51years representing 10% and none of the teachers was below 30years.

4.1.3 Teachers' experience, academic and professional qualification and in-service training

The study sought information on the teachers' experience, academic and professional qualification and in-service training attended by teachers as this was deemed to have a

bearing on the biology curriculum implementation. The data obtained on this were presented in tables below.

The teaching experience of teachers was examined and presented in Table 3.

Table 3: Teacher Teaching Experience

Year of experience	**Freq.**	**%**
1-5	2	20
6-10	5	50
11-15	1	10
16-20	1	10
21 and above	1	10
Total	**10**	**100**

Source: Field data, 2022.

Table 3 indicates that, out of the 10 biology teachers involved in this study two (20%) had only taught biology for less than 5years and half of them five (50%) of the biology had taught biology for 6 -10 years. Only one (10%) teacher had taught for between 11 and 15years. It is interesting to note that of the 10 teachers of biology under study only two (20%) had taught for more than 15 years.

The highest academic qualifications of the teachers are captured in Table 4.

Table 4: Highest Academic Qualification of Teachers

Highest qualification	**Freq.**	**%**
1st Degree	7	70
Masters	3	30
Doctorate degree(PhD)	0	0
Total	**10**	**100**

Source: Field data, 2022.

Table 4 reveals that seven (70%) of the biology teachers were graduate teachers having their first degree while three (30%) had Master degrees. Out of the 10 teachers sampled for this study, none of them had doctorate degree.

The next table (Table 5) shows the professional qualification of teachers.

Table 5: Professional Qualification of Teachers

Professional Qualification	**Freq.**	**%**
(Cert. A) Edu.	1	10
Dip. Edu.	2	20
PGDE	1	10
B. Ed	3	30
M. Ed	3	30
Total	**10**	**100**

Source: Field data, 2022.

Table 5 reveals that all the teachers sampled in this study were professional teachers. Out of the 10 teachers sampled, only one (10%) had certificate A in education, two (20%) had Diploma in education, one (10%) had PGDE, three (30%) had Bachelor Education degrees and three (30%) had Masters in Education degree.

Table 6: Teacher Specialization

Specialization	**Freq.**	**%**
Biology	7	70
Chemistry	0	0
Physics	0	0
Agriculture	3	30
Total	**10**	**100**

Source: Field data, 2022.

Table 6 reveals that seven (70%) teachers had specialization in biology and the remaining three (30%) specialized in agriculture. None of the teachers specialized in chemistry and physics.

Table 7 below represents the number of in-service training attended by the teachers.

Table 7: In-Service Training Attended by Teachers

In-service training	Freq.	%
Never	0	0
Once	0	0
Twice	5	50
More than twice	5	50
Total	**10**	**100**

Source: Field data, 2022.

Table 7 indicates that all the teachers teaching biology attended in-service training. Out of the 10 teachers sampled for this study, half five (50%) of them attended the in-service training twice whilst the remaining half five (50%) teachers attended in-service training more than twice.

Teachers were asked for their opinion on the benefit of in-service training they attended. Their views are captured and presented in Table 8.

Table 8: Evaluation of In-Service Training Attended by Teachers

Evaluation	Freq.	%
Very helpful	7	70
Moderately helpful	0	0
Helpful	3	30
Not helpful	0	0
Total	**10**	**100**

Source: Field data, 2022.

Table 8 reveals that the in-service training attended by teachers was very helpful. More than half seven (70%) of teachers admitted that the training was very helpful while the remaining three (30%) of teachers said the training was helpful.

4.2 Research Question Two: How often do the biology teachers utilise the available teaching resources and physical facilities for teaching and learning of biology the implementation of biology curriculum?

4.2.1 Available Teaching Resources

The question was asked to know how often biology teachers used particular laboratory equipment and materials in the laboratory for biology lessons. Teachers' frequent usages of such items are shown in Table 9.

Table 9: Frequency Use of Instructional Materials

S/N	Materials	VOU	OU	SU	NU	Mean	S. D
1.	Charts	4 (40)	4 (40)	1 (10)	1 (10)	3.10	0.994
2.	Microscope	4 (40)	5 (50)	1 (10)	0 (0)	3.30	0.675
3.	Hand lens	6 (60)	3 (30)	1 (10)	0 (0)	3.50	0.707
4.	Fehling solution	0 (0)	7 (70)	2 (20)	1 (10)	2.60	0.699
5.	Benedict solution	0 (0)	7 (70)	2 (20)	1 (10)	2.60	0.699
6.	Iodine solution	1 (10)	6 (60)	1 (10)	2 (20)	2.60	0.699
7.	Projector	1 (10)	1 (10)	1 (10)	7 (70)	1.60	1.075
8.	Dissecting board	3 (30)	2 (20)	1 (10)	4 (40)	2.40	1.350
9.	Human skeleton	5 (50)	3 (30)	1 (10)	1 (10)	3.20	1.033
10.	Insect nets	0 (0)	7 (70)	2 (20)	1 (10)	2.60	0.699
11.	Lesson plan	6 (60)	4 (40)	0 (0)	0 (0)	3.60	0.516
12.	Scheme of work	8 (80)	2 (20)	0 (0)	0 (0)	3.80	0.422

Source: Field data, 2022

Key: Very Often Used (VOU) = 4, Often Used (OU) = 3, Seldom Used (SU) = 2, and Not Used (NU) = 1

The data in Table 9 were used to answer the third research question on the extent of biology teachers' utilization of the available instructional materials. Table 9 revealed that the very often used materials in teaching and learning biology scheme of work, lesson plan, and hand lens with a mean value of approximately 4.0. Fehling solution, Benedict solution, Iodine solution and insect net are the second sets of instructional materials often utilized by teachers with approximately a mean value of 3.0. The result from the Table 9 also indicates that, projector and dissecting board not used by teachers in teaching and learning of biology with a mean value of approximately 2.0. In conclusion, the result shows that the prescribed instructional materials were available and often utilized by teachers in their biology lessons.to a large extent.

4.2.2 Physical Facilities and Teaching and Learning Materials

Physical structure and facilities of a school play an important role in the implementation process of any curriculum. The data collected through researcher observation schedules is displayed in Table 10 and 11.

4.2.2.1 Library

The availability and reliability of library as revealed by the researcher's observation guideline is unravelled in Table 10.

Table 10: Library Availability and Reliability (N=4)

S/N Responses	Library Availability & Reliability	
	(F)	**(%)**
1. Available	3	75
2. Not available	1	25
3. Convenient opening hours	3	75
4. Hours not convenient	1	25
5. Librarian present	1	25
6. Librarian absent	3	75
7. Enough biology books for borrowing	3	75
8. Biology teachers make use of the library	3	75

Source: Field data, 2022

Results from Table 10 reveals that three (75%) of the sampled schools had a library with enough biology books for borrowing while only one (25%) school had no library that lacked biology resources for borrowing. Three of the sampled schools had no librarians and this is posing a challenge to teaching and learning of biology though it was conveniently opened. It was also revealed from the study that voluntary teachers acted as a school librarian. Teachers' made use of the library however, no reference books for further reading by both teachers and students.

4.2.2.1 Laboratory

The findings on the availability and reliability of the laboratory in the sampled school are revealed in Table 11.

Table 11: Availability and Reliability of Laboratory

S/N Responses	Laboratory		
		(Freq.)	(%)
1. Available		4	100
2. Not available		0	0
3. Well equipped		2	50
4. Not well equipped		2	50
5. Qualified lab technician		2	50
6. Unqualified lab technician		2	50
7. Biology lab present		1	25
8. Biology lab absent		3	75
9. Number of lab available in schools	1.	3	75
	2.	0	0
	3.	1	25

Source: Field data, 2022.

Table 11 reveals that all the sampled schools 4(100%) had laboratories in their schools. However, two (50%) had well equipped laboratories while the other two (50%) had poorly equipped laboratories which is a challenge to teaching Biology. Two (50%) of the sampled schools had qualified lab technicians while two (50%) had unqualified lab technicians. There was only one (25%) of the sampled schools with three laboratories (biology, physics and chemistry) while one (25%) of the schools had a biology laboratory only. Three (75%) of the schools had only one laboratory each. This means the same laboratory is being used for biology, physics and chemistry in delivering science lessons.

4.2.2.2 Resources / Materials Available in the Laboratories

A resource used in biology laboratory supports effective and meaningful teaching and learning of biology. The Table 12 reveals the availability and frequency of use of materials in the laboratory.

Table 12: Availability and Frequency of Use of Biology Materials in the Laboratory

Material	Adequate		Inadequate		Not present		Frequency of use					
							1		2		3	
	F	%	F	%	F	%	F	%	F	%	F	%
1. Common reagent	3	75	1	25	0	25	0	1	0	0	0	0
2. Preserved specimen	2	50	2	50	0	0	2	50	0	0	2	50
3. Models	2	50	1	25	1	25	2	50	0	0	2	50
4. Charts	1	25	3	75	0	0	3	75	0	0	1	25
5. Diagrams	1	25	2	50	1	25	4	100	0	0	0	0
6. Dissecting kits	0	0	1	25	3	75	0	0	2	50	2	50
7. Microscope	2	50	1	25	1	25	3	75	1	25	0	0
8. Pictograms	0	0	0	0	4	100	0	10	0	0	4	100
9. Photographs	0	0	1	25	3	75	0	0	1	25	3	75
10. Herbarium	0	0	0	0	4	100	0	0	0	0	4	100
11. Vivarium	0	0	1	25	3	75	0	0	0	0	4	100
12. Botanical garden	0	0	1	25	3	75	0	0	0	0	4	100

Source: Field data, 2022.

Key: 1 = frequently used, 2 = rarely used, 1= Not used

The data from Table 12 reveals that the key biology resources available in the laboratory were common reagents as revealed by three (75%) of school, preserved specimen two (50%), models two (50%), charts one (25%), diagrams one (25%) and microscopes two (50%). The results also shows all the four (100%) of the schools used diagrams most frequency followed by charts three (75%) and preserved specimen two (50%). The biology resources which are not there or present in the laboratories include pictograms as revealed by four (100%) of the school, herbarium and vivarium both also revealed by four (100%) of the school. The same resources were also not used in all the schools, four (100%) since they were not available. The frequency of use of the resources depends on their availability and if there are no resources for teaching biology then these poses a major challenge.

4.2.2.3 Safety Measures in the Biology Lab

Safety and precautionary measures adopted in the laboratories of sampled schools are revealed by the researcher's observation guideline in Table 13.

Table 13: Safety Measures

S/N	Safety Measures	YES		NO	
		Freq.	%	Freq.	%
1)	Safety guidelines pasted in laboratory	0	0	4	100
2)	Fire extinguishers in the laboratory	0	0	4	100
3)	Students put on laboratory coat	0	0	4	100
4)	First-aid kit in the biology laboratory?	0	0	4	100
5)	Cabinet for keeping and storing	1	25	3	75
6)	Electrical outlets near water sources protected?	0	0	4	100
7)	Student wear nose mask and hand gloves	0	0	4	100
8)	Regular maintenance to ensure that safety	0	0	4	100
9)	Safety training in schools	0	0	4	100
10)	School/district conducts inspections?	0	0	4	100

Source: Field data, 2022.

Table 13 reveals that precautionary measures in the biology laboratory in the 4 sampled schools revealed that none four (100%) of the sampled schools met the safety laws and standards especially with respect to safety guidelines pasted in laboratory, fire extinguishers in the laboratory, students put on laboratory coat, first-aid kit in the biology laboratory, cabinet for keeping and storing, electrical outlets near water sources protected, student wear nose mask and hand gloves , regular maintenance to ensure that safety, safety training in schools, and school/district not conducting inspections The 4 sampled schools were faced with quite a few critical challenges to safety of teachers and students.

4.3 Research Question Three: What evaluation techniques are used by teachers in assessing their students?

The question sought to find out the kinds of assessment techniques used by biology teachers in assessing their students as recommended by the curriculum. The information to this question is found in Table 14.

Table14: Evaluation Techniques Used by Teachers

S/N	Evaluation M	Mean	S. D
1.	Quizzes	3.50	0.527
2.	Oral questioning	3.40	0.516
3.	Essay writing	1.80	0.919
4.	Multiple choice	3.40	0.699
5.	True or false	2.20	0.919
6.	Matching of items	2.10	0.876
7.	Completion of blanks	2.80	0.632
8.	Assignment	3.70	0.483
9.	Project assessment	2.70	1.160
10.	Laboratory work	3.00	0.816
11.	Home work	2.90	0.316

Source: Field data, 2022

The data in Table 14 show that assignment and quizzes are the very often used evaluation technique by teachers with mean value of approximately 4.0, oral questioning, multiple choice, laboratory work, home work, project assessment, and completion of blanks are often used by biology teachers with mean value of approximately 3.0. The result also revealed that, true or false, matching of items, and essay writing evaluation technique were seldom used in assessing students' with a mean value of approximately 2.0. The result therefore, shows that the recommended evaluation techniques for assessing secondary school biology students by teachers were being used.

4.4 Research Question Four: What are the instructional strategies used by teachers in teaching biology as suggested by the curriculum?

Instructional strategies used by teachers in teaching biology lessons in the classroom are captured in Table 15 and 16.

Table 15: Teaching Techniques Used by Teachers

S/N	Teaching Techniques	Mean	S. D
1.	Lecture method	3.50	0.707
2.	Project method	2.90	0.876
3.	Demonstration method	3.20	0.422
4.	Discovery method	2.10	1.101
5.	Discussion method	3.50	0.527
6.	Inquiry method	1.90	1.101
7.	Laboratory method	2.70	0.675
8.	Problem solving method	2.90	0.568
9.	Concept mapping method	1.50	0.972
10.	Cooperative learning method	1.80	1.033

Source: Field data, 2022

From Table 15, the instructional strategies used by biology teachers based on the questionnaire were interpreted using the following criterion. four as very often used, three as often used, two as seldom used and one as not used. The data in Table 15 revealed that the very often used teaching method were Lecture method and Discussion method with approximately mean value of 4.0. The often used methods were project method; demonstration method; laboratory method; and problem solving method with approximately mean value of 3.0.

Teaching methods that were seldom used includes discovery method; inquiry method; concept mapping method and cooperative learning method with mean value of approximately 2.0. The result clearly shows that teachers are not using the appropriate

teaching methods recommended for use in the biology curriculum in delivering biology lessons such as inquiry method, concept mapping method, cooperative learning method etc. which are more student- centred and student- directed than the traditional method (lecture method).

Table16: Level of instructional strategies in the Studied Schools

S/N	LESSON FEATURES	Mean	S. D
	INSTRUCTIONAL BEHAVIOUR		
1.	Introduction (relevance, interesting, motivating)	3.70	0.675
2.	Use of language (accurate, fluent)	3.80	0.632
3.	Explain concept	3.70	0.949
4.	Give directive	3.20	1.033
5.	Mastery of subject matter (adequate, accurate)	3.90	0.738
6.	Class management (effective teaching, maintaining discipline)	3.30	0.949
7.	Treatment of students' responses	3.80	0.789
8.	Make reference (charts, models, videos, etc. i.e. TLMs)	2.10	1.101
9.	Give practical work	2.10	1.524
10.	Summary and conclusion (good evaluation, question, follow up assignment	3.60	0.699
	METHODOLOGY		
11.	Lecture	4.50	0.707
12.	Discussion	3.00	1.247
13.	Inquiry	1.00	0.000
14.	Demonstration	2.10	1.449
15.	Practical work	2.20	1.619
	STUDENTS' ENGAGEMENT		
16.	Listen to teacher	3.00	1.155
17.	Make observation	1.60	1.155
18.	Set experiment	1.30	1.265
19.	Handle equipment	1.30	0.675
20.	Record observation	1.70	1.160
21.	Work out example	2.30	1.160
22.	Answer teachers question	2.50	1.354

Source: Field data, 2022

From Table 16, the various aspects of teaching effectiveness based on the observation of classroom teaching carried out and the criterion for interpretation used:

Mean score of five as excellent, four as very good, and three as good, two as fair and one as poor. Under instructional behaviour, out of the 10 features, only six features were rated very good with approximately mean score of 4.0 while two features were rated good with approximately mean value of 3.0 and the remaining two features were rated fair with approximately mean score of 2.0 respectively. No feature under instructional behaviour was rated poor.

Under methodology, the results also revealed that only lecture method was rated excellent with approximately mean value of 5 because majority of teachers used it more often in delivering their biology lessons. Discussion method with a mean value of 3.0 was rated good while demonstration and practical work methods were rated fair with mean value of approximately 2.0 while inquiry method was rated poor with a mean value of 1.0. This information clearly shows that biology teachers were not complying with the teaching strategies recommended in the biology curriculum which are inquiry method, practical work, and demonstration etc. but resort to the traditional way of teaching (lecture method) which is more teacher-centred than student-centred and student directed.

The result also indicates that students' engagement by biology teachers during biology lessons recorded poor ratings. From the information obtained, students listening to teacher and answering teacher questions were rated good with mean value of approximately 3.0 indicating that students are just sitting down listening to the teacher without actively participating in the lesson as a result of poor teaching strategy (lecture method) being adopted by teachers which is being discouraged

worldwide because it is more teacher-centred than students-centred. The result also shows that in biology lessons, students are not fully engaged by biology teachers in making and recording their own observations which were rated as fair with mean value of 2.0 approximately. Lastly, students setting experiment and handling equipment under students' engagement were rated poor with mean value of 1.0 approximately.

4.5 Discussion of Findings

Discussion of Findings Based on Research Questions

Research Question One: What are student and teacher characteristics that influence the process of curriculum implementation?

4.5.1 Teachers Characteristics

Out of the 10 teachers sampled, only six (60%) are males and the remaining four (40%) constituted females. Teachers' sex was reported by Evans (1986) as one of the potentially important determinants of the biology curriculum implementation process. Majority of teachers ranged from 31 - 40 years representing 60% of the total sampled. The few of them were between 41 - 50 years representing 30%. Only one was above 51years representing 10% and none of the teachers was below 30years. Similar to the findings of Ekici's (1996) study, the results of this study showed that teachers younger than 30 and teachers between the ages of 36 and 40 used the lecturing method more often than teachers in other age groups. Similarly, teachers younger than 30 and teachers between the ages of 31 and 35 used the demonstration method more frequently than teachers in other age groups during instruction.

The result reveals that, only two (20%) had only taught biology for less than 5years. The majority five (50%) of the biology teachers had taught biology for 6 -10 years.

Only one (10%) teachers had taught for 11-15years.It is interesting to note that of the 10 teachers of biology only two (20%) had taught for more than 15 years. Teaching experience is identified as another factor influencing the process of curriculum implementation Cho (2001). However, Cho noted that novice teachers use curriculum faithfully confronting to the curriculum developers' intentions.

The result reveals that seven (70%) of the biology teachers are graduate teachers having their first degree while three (30%) hold Master's degree. Out of the 10 teachers sampled for this study, no biology teacher had doctorate degree. However, none of the biology teachers hold SSCE/WASSCE certificate and HND which are not qualifications acceptable for the teaching of science in senior high schools. The result also reveals that reveals that all the teachers sampled in this study are professional teachers. Out of the 10 teachers sampled, only one (10%) had certificate A education, two (20%) had Diploma in education, one (10%) had PGDE, three (30%) had Bachelor education and three (30%) had Masters in education. It was also found that the few available biology teachers are largely qualified with professional qualification and good level of experience; this is in contrast with the study of Odetoyinbo (2004) that many biology teachers are unqualified for the job they are doing. Therefore, the study reveals that teachers had the academic and professional qualifications to teach biology in the study schools as poor qualified teachers are likely to transmit wrong descriptions of observations, misconceptions, misinformation and misapplication of content taught.

The results also showed that out of the 10 teachers sampled for this study, only five (50%) teachers attended the in-service training twice whilst the remaining five (50%) teachers attended the in-service training more than twice. The result of the study is

supported by Jess et al. (2016) argued that teachers need the capacity to design developmentally appropriate learning tasks that are aligned to curricular expectations. The focus of training and professional development requires an emphasis on teaching how best to interpret the curriculum so that students' needs would be aligned with appropriate instructional practices. Osaki (1999) suggested professional development of the teachers as a temporary measure while a more long term solution is awaited.

Professional development was recommended in order to raise teacher awareness and understanding of a variety of professional skills that are still at a low state. It is widely acknowledged that teachers can no longer adhere to their traditional role of transmitting knowledge (Kwakman, 2003) when implementing reform-based curriculum designed to support students' construction of knowledge in science (Schneider & Krajcik, 2002). For many teachers this means substantial change in their instructional practices: they must create a stimulating learning environment and change their role from lecturer to facilitator of the students' learning processes (Kwakman, 2003). In most of the cases teachers need to learn a great deal to be able to enact reform-based curriculum. Traditionally they attend courses, training, or conferences and read professional journals to refresh and update their knowledge and skills. Educative curriculum materials designed to address their learning is another vehicle to support them on a large scale. However, Kwakman (2003) points out that these traditional professional development activities fall short of helping teachers to teach for understanding rather than rote learning.

Research Question Two: How often do the biology teachers utilise the available teaching resources and physical facilities for teaching and learning of biology the implementation of biology curriculum?

The data in Table 9 presented the biology teachers' extent of utilization of the available instructional materials. From the table, one can see that both teachers agreed that charts, microscopes, hand lens, Fehling solution, Benedict solution, Iodine solution, dissecting boards, human skeleton, insect nets, lesson plan and scheme of work were available and are often used in teaching biology more often. The result however disagrees with the finding of Idoko (2001) who reported that available equipment and materials were under-utilized. Hence, the study revealed that teachers are frequently using available teaching materials to teach biology.

Results from table 10 reveals that three (75%) of the sampled schools have a library with enough biology books for borrowing while only one (25%) school had no library that lacked biology resources for borrowing. Though it was conveniently opened, this posed a challenge to teaching and learning of biology as there were no school librarians in three of the schools sampled. It was revealed from the study that voluntary teachers are the ones acting as school librarian. Teachers' make use of the library but no reference books for further reading by both teachers and students. Table 21 reveals that all the sampled schools had laboratories. However only two (50%) had well equipped laboratories while the other two (50%) had poorly equipped laboratories which is a challenge to teaching biology. Result shows that two (50%) of the sampled schools had qualified lab technicians while two (50%) had unqualified lab technicians. There was only one (25%) of the sampled schools with three laboratories while one (25%) of the schools had a biology laboratory alone. The results also revealed that three (75%) of the school had only one laboratory.

The data from table 11 reveals that the key biology resources available were common reagents (75%), preserved specimen (50%), models (50%), charts (25%), diagrams (25%) and microscopes (50%). The results also shows that diagrams are the most frequency used (100%) followed by charts (75%) and preserved specimen (50%). The biology resources which are not there in the laboratories include pictograms (100%), herbarium (100%), vivarium (100%) and botanical gardens (100%) as revealed from the schools. The same resources were also not used in all the schools, four (100%) since they were not available. The frequency of use of the resources depends on their availability and if there are no resources for teaching biology then these poses a major challenge. The findings from the study revealed the availability of physical facilities in the sampled schools. This is confirmed by Amanuel (2009) that laboratories are necessary in a school as instructional facilities for effective science programmes where development of scientific skills and attitudes are greatly facilitated.

Results from Table 13 revealed that safety and precautionary measures in the biology laboratory in the four sampled schools revealed that none of the sampled schools met the safety laws and standards especially with respect to area, size, and the existence of proper equipment. The four sampled schools were faced with quite a few critical challenges to safety of teachers and students.

The findings of this study, although based on a relatively small sample size, provide through its exploratory nature a depiction of the current status of safety of laboratories in our schools.

Research Question Three: What evaluation techniques are used by teachers in assessing their students?

The data in Table 14 show the mean rating on evaluation techniques used by biology teachers in assessing their students. The criterion used in mean rating were four as very often used, three as often used, two as seldom used and one as not used. The finding shows that the very often used evaluation techniques by teachers were quizzes and assignments with approximately mean value of 4.0. The often used evaluation techniques by teachers were oral questioning, multiple choice, true or false, matching of items, completion of blanks, project assessment, laboratory work and home work with a mean value of approximately 3.0 while essay writing, true or false, and matching of items were seldom used by teachers in assessing their students' with a mean value of approximately 2.0. Therefore, the result of the study indicates that teachers were using the recommended evaluation techniques in assessing their students which will go a long way in helping the implementation of biology curriculum.

Research Question Four: What are the instructional strategies used by teachers in teaching biology as suggested by the curriculum?

The result in Table 15 indicates that, teachers' used Lecture method Excellent with a mean rating of 5.0 approximately followed by Discussion method that was rated as Very Good with mean value of 3.0. Demonstration and Practical work were rated as Fair with mean value of approximately 2.0 while Inquiry method was rated poor with mean value of 1.0.

The findings reveals that teachers are not complying with the teaching strategies recommended for in the biology curriculum in delivering biology lessons. The result

however is not in lined with the Curriculum Research and Development Division (CRDD) of the Ghana Education Service (2010) that encourages the use of this inquiry, cooperative methods, demonstration method and practical work method as these methods were extremely student-centered and student-directed, and can be modified for students at any level, reaching them where they are.

The findings was not in support with Griffin, (2007) who opined that appropriate use of teaching methods play an important role in producing good students' performance and in the implementation of curriculum intentions. Furthermore, several studies conducted on teaching methods in many parts of the world (Haas, 2002; Asikia, 2010; Bategeka, 2012; Luntungan, 2012), have demonstrated that application of appropriate teaching methods impact students' performance and implementation of curriculum intentions. In conclusion, The National Curriculum for secondary schools recommends the use of inquiry method of teaching biology because of its obvious advantages over the other methods. "Lecture" method which is popularly employed by teachers in teaching biology as revealed from the study has actually been criticized by scholars not as effective as "Inquiry" method. This would therefore adversely affect successful implementation of the biology curriculum as it is not been employed by teachers as revealed from this study.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS AND FURTHER RESEARCH

5.0 Overview

This chapter presents the summary of the findings, conclusion, and recommendations on the evaluation of senior high school biology curriculum implementation. Also suggestions for future research work have been made.

5.1 Summary of Findings

The main findings of the study are:

1. The study revealed that all the teachers in the four sampled schools are academically and professionally qualified with rich experience more than five years. This is supported by data in Table 3, 4 and 5.
2. The findings from the study also shows that teachers were not using instructional materials or resources in delivering their lessons to make it student-centered as recommended in the secondary school biology curriculum. This is supported by data in Table 9, 12 and 15.
3. The findings revealed that Lecture method is the most frequently instructional strategy used by teachers in teaching biology in the study schools though it is not recommended for in the biology curriculum. The results therefore, shows that teachers are not employing with instructional strategies such as inquiry, concept mapping and cooperative learning method recommended for in the biology curriculum. This is supported by data in Table 15 and 16.
4. The findings revealed that the very often used evaluation techniques in assessing students in the study schools were quizzes and assignment. This is supported by data in Table 14.

5. The findings of the study revealed that though the four sampled schools had biology laboratories and libraries they do not function well. It was also found in this study that the schools had inadequate biology laboratories for the implementation of secondary school biology curriculum. This is supported by data in Table 10, 11 and 12
6. The findings also revealed that none of the sampled schools met the safety rules, laws and standards especially with respect to safety guidelines in the laboratory; fire extinguishers installations, first-aid kits, wearing of laboratory coat, proper cabinets for keeping dangerous chemicals. This is supported by data in Table 13.

5.2 Conclusions

In conclusion all the four objectives of the study were achieved. The first objective was to find out teacher characteristics influenced biology curriculum implementation. The study findings revealed that all the sampled teachers are academically and professionally qualified with more than five years teaching experiences to teach biology. The second objective was to find out how teachers utilized available teaching materials and availability of physical facilities. The findings from the study revealed that teachers are utilizing the teaching materials to a moderately extent. The study findings also revealed that the availability and reliability of the resources and physical facilities have a great bearing to the teaching and learning of biology in the sampled schools. The third objective was to found out evaluation techniques often used by biology teachers in assessing their students. The research findings revealed that teachers very often used quizzes and assignments the remaining evaluation techniques. The last objective was to found out instructional strategies used by teachers in teaching biology. The research findings revealed that teachers very often used lecture method which was not recommended for in the biology curriculum. The

findings also revealed that inquiry method; concept mapping method,; cooperative learning method and discovery method recommended for in the biology curriculum which are more student-centred and student-directed were not being used by teachers in teaching biology. The study findings also revealed that teacher effectiveness in biology classroom lesson yielded poor ratings with regards to instructional behaviors; methodology of teaching and student engagement. In conclusion, senior high school biology curriculum and its intentions were not well implemented in the study area.

5.3 Recommendations

The following recommendations were made:

1. The schools should renovate their biology laboratories, and Government through grants should restock these laboratories in terms of necessary equipment or apparatus, chemicals, and models and other required teaching and learning materials to ensure effective teaching of biology in schools that will help in the implementation of biology curriculum.
2. In-service training and professional development workshops and seminars should be organized periodically for biology teachers to educate and update them on new trends of instructional strategies recommended for in the biology curriculum.

5.3 Suggestion for Further Research

1. This study only concentrated on the evaluation of the implementation of senior high school biology curriculum among secondary schools in South-Dayi District of Volta Region. A similar study should be carried out by other interested scholars in the same region to gather adequate and generalizable information on the subject.

2. In order to collect rich data with the purpose of improving biology education in Ghana, ıt is better to combine a survey questionnaire with teacher and student; school management team, district director interviews; classroom observations; and document reviewed in the future research. Since students also actively participate in the implementation process together with teachers their thoughts and perceptions should also be examined in the future research.

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APPENDICES

APPENDIX A

TEACHER QUESTIONNAIRE

INTRODUCTION

I am **DANIEL DZOMEKU**; a **Master of Philosophy (M. Phil.)** student in **Biology** at **University of Education, Winneba**. I am conducting an academic research on ***Evaluation of the Implementation of SHS Biology Curriculum in South- Dayi District of Volta Region.*** You have been selected to participate in this survey. Your answers will remain strictly confidential and they will be used only for research purposes on aggregate and information given will be accorded utmost confidentiality. Please fill in the questionnaire as diligently as you can. Tick in the appropriate box where the question requires you to do so, where the space is provided, please fill in your answer. Thank you.

General Information

Note: This information is required for background information only. The names of individual students, teachers and I or schools will not be published. Please **tick** in the **box** that is applicable and **fill** in the **blank space** where necessary.

TEACHER CHARACTERISTICS QUESTIONNAIRE (TCQ)

1. Sex: Male [ ] Female [ ]

2. Age: 21-30yrs [ ] 31-40yrs [ ] 41-50yrs [ ] 51-60yrs [ ]

3. How long have you been teaching biology? 1-5yrs [ ] 6-10yrs [ ] 11-15yrs [ ] 16 -20yrs [ ] 21yrs and above [ ]

4. What is your highest academic qualification? SSCE/WASSCE [ ] HND [ ] BSc [ ] MSc [ ] M.Phil. [ ] PhD [ ]
   Any other, specify……..
5. What is your professional qualification? Dip Ed. [ ] PGDE [ ] B.Ed. [ ] M.Ed. [ ]
6. What is your area of specialization? Biology [ ] Chemistry [ ] Physics [ ] Agric. Science [ ] any other please (specify)……
7. Have you attended any in-service training programme as a teacher? Never [ ]
8. Once [ ] Twice [ ] More than 2 times [ ]
9. Evaluate the in-service training programs attended: Very helpful [ ] Moderately [ ] helpful [ ] Not helpful [ ]

Instructions: Please indicate with a **tick** (√) under appropriate column that is applicable and **fill** in the **blank space** where necessary. Note that: Very Often Used (VOU) = 4, Often Used (OU) = 3, Seldom Used (SU) = 2, and Not Used (NU) = 1

APPENDIX B

THE AVAILABILITY OF INSTRUCTIONAL MATERIALS AND RATE OF USAGE

	Material	Rate of usage			
		VOU 4	OU 3	SU 2	NU 1
1)	Charts				
2)	Microscopes				
3)	Hand lens				
4)	Fehling solution				
5)	Benedict solution				
6)	Iodine solution				
7)	Projector				
8)	Dissecting boards				
9)	Human skeleton				
10)	Insect nets				
11)	Lesson plan				
12)	Scheme of work				

APPENDIX C

RESEARCHER'S OBSERVATION GUIDELINES ON PHYSICAL FACILITIES

SCHOOL ……

FACILITIES AND RESOURCES

LIBRARY

1. Do you have a school library? Yes [ ] No [ ]
2. How many hours does the library operate in a day? 6hrs [ ] 12hrs [ ] 18hrs [ ] 24hrs [ ]
3. Are there librarians? Yes [ ] No [ ]

   If not, who is responsible?……
4. Are there enough biology books for borrowing? Yes [ ] No [ ]
5. Does the library lend books to students? Yes [ ] No [ ]
6. Do biology teachers' make use of the library? Yes [ ] No [ ]

SECTION B: LABORATORY

1. Are there laboratories? Yes [ ] No [ ]
2. How many laboratories are there in the school? {1} .....{2} .....{3}
3. Is there one for Biology alone? Yes [ ] No [ ]
4. Is the laboratory well equipped with materials for work? Yes [ ] No [ ]
5. Is there a qualified laboratory assistant? Yes [ ] No [ ]

APPENDIX D

ADEQUACY OF BIOLOGY LABORATORY (AOBL)

S/N	Material	Adequate	Inadequate	Not present	Frequency of use		
					3	2	1
1.	Common Reagents						
2.	Preserved specimen						
3.	Models						
4.	Charts						
5.	Diagrams						
6.	Dissecting kits						
7.	Microscope						
8.	Pictograms						
9.	Photographs						
10.	Herbarium						
11.	Vivarium						
12.	Botanical garden						

Key: 3= frequently used, 2 = rarely used, 1= Not used

SAFETY MEASURES IN THE BIOLOGY LABORATORY

1) Is there safety guidelines pasted at the entrance of biology laboratory? Yes [ ]
   No [ ]
2) Are there fire extinguishers in the biology laboratory? Yes [ ] No [ ]
3) Do students put on laboratory coat before entering the laboratory? Yes [ ]
   No [ ]
4) Is there a first-aid kit in the biology laboratory? Yes [ ] No [ ]
5) Is there a cabinet for keeping and storing dangerous chemicals? Yes [ ] No [ ]
6) Are all lab electrical outlets near water sources protected? Yes [ ] No [ ]

7) Student wear nose mask and hand gloves in the lab when dealing with dead animals? Yes [ ] No [ ]
8) Do you have a scheduled regular maintenance to ensure that safety equipment in your lab is in working condition? Yes [ ] No [ ]
9) Do you provide your students with safety training at the beginning of each semester/year? Yes [ ] No [ ]
10) Does your school/district conduct frequent and thorough laboratory inspections? Yes [ ] No [ ]

APPENDIX E

EVALUATION TECHNIQUES USED BY BIOLOGY TEACHERS IN ASSESSING THEIR STUDENTS

Instructions: Please indicate with a **tick (√)** under appropriate column that is applicable. Note that: Very Often Used (VOU) = 4, Often Used (OU) = 3, Seldom Used (SU) = 2, and Not Used (NU) = 1

S/N	Evaluation Techniques	VOU 4	OU 3	SU 2	NU 1
1.	Quizzes				
2.	Oral questioning				
3.	Essay writing				
4.	Multiple choice				
5.	True or false				
6.	Matching of items				
7.	Completion of blanks				
8.	Assignment				
9.	Project assessment				
10.	Laboratory work				
11.	Home work				

APPENDIX F

Teachers' teaching methods and techniques recommended for use in the biology curriculum

Instructions: Please indicate with a **tick (√)** under appropriate column that best describes your teaching method. Note that: Very Often Used (VOU) = 4, Often Used (OU) =3, Seldom Used (SU) =2, and Not Used (NU) = 1.

	Teaching Methods	**VOU 4**	**OU 3**	**SU 2**	**NU 1**
1.	Lecture method				
2.	Project method				
3.	Demonstration method				
4.	Discovery method				
5.	Discussion method				
6.	Concept mapping				
7.	Inquiry method				
8.	Laboratory method				
9.	Cooperative learning				
10.	Excursion/field trip				

APPENDIX G

BIOLOGY CLASSROOM OBSERVATION SCHEDULE (BCOS) TEACHER EFFECTIVENESS

1. Name of School……
2. Form……..
3. Period…….
4. Topic……..

KEY: Excellence = 5, Very Good = 4, Good = 3, Fair = 2, And Poor = 1

	LESSON FEATURES	5	4	3	2	1
S/N	**Instructional behavior**					
1.	Introduction (relevance, interesting, motivating)					
2.	Use of language (accurate, fluent)					
3.	Explain concept					
4.	Give directive					
5.	Mastery of subject matter (adequate, accurate)					
6.	Class management (effective teaching, maintaining discipline)					
7.	Treatment of students' responses					
8.	Make reference (charts, models, videos, etc.)					
9.	Give practical work					
10.	Summary and conclusion (good evaluation, question, follow up assignment)					

	METHODOLOGY					
11.	Lecture					
12.	Discussion					
13.	Inquiry					
14.	Demonstration					
15.	Practical work					
	STUDENTS' ENGAGEMENT					
16.	Listen to teacher					
17.	Make observation					
18.	Set experiment					
19.	Handle equipment					
20.	Record observation					
21.	Work out example					
22.	Answer teachers question					

APPENDIX H

INTRODUCTORY LETTER

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF SCIENCE EDUCATION
DEPARTMENT OF INTERGRATED SCIENCE EDUCATION
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Our ref. No.: ISED/PG.1/Vol.1/34
Your ref. No.:

1st September, 2022

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF INTRODUCTION
MR. DZOMEKU, DANIEL

We write to introduce, Mr Dzomeku is a MPhil. student of the Department of Science Education, University of Education, Winneba, who is conducting a research titled:

EVALUATION OF THE IMPLEMENTATION OF SHS BIOLOGY CURRICULUM IN SOUTH –DAYI DISTRICT OF VOLTA REGION

We would be very grateful if you could give the assistance required.

Thank you.

Yours faithfully,

MS. ALEXANDRA N. DOWUONA
CHIEF ADMINISTRATIVE ASSISTANT
For: HEAD OF DEPARTMENT