UNIVERSITY OF EDUCATION, WINNEBA

PUBLIC AND PRIVATE JUNIOR HIGH SCHOOL INTEGRATED SCIENCE TEACHERS' CURRICULUM KNOWLEDGE, CLASSROOM INSTRUCTIONAL AND ASSESSMENT PRACTICES IN THE EFFUTU MUNICIPALITY

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SEPTEMBER, 2019

DECLARATION

STUDENT`S DECLARATION

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

Signature……………………………..

Date…………………………………..

SUPERVISORS` DECLARATION

We 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.

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DEDICATION

This thesis is dedicated to my daughter Tricia-Fiona Kweigyiba Boakye

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ABSTRACT

The study sought to explore Integrated science teachers" curriculum knowledge, classroom instructions and assessment practices in the Effutu Municipality. A mixed method sequential explanatory research design was used for the study. Data were collected by administering integrated science teachers" curriculum knowledge (ISTCK) questionnaire and assessment practices questionnaire to 76 teachers in both Public and Private schools in the Effutu Municipality. Out of 76, 75 participants completed and submitted their questionnaire making a return rate of 98.6%, Quantitative data were analysed using descriptive statistics, and Pearson Product-Moment Correlation functions of the Statistical Product for Service Solutions (SPSS) version 22. In the qualitative phase of the study, inquiry-based observational guide and semi-structured interview guide were used to explore in-depth information on integrated science teacher"s curriculum knowledge, classroom practices. Some key findings that emerged from the study were: Majority of the teachers" had weak science background knowledge. Also, the Ghanaian JHS science teachers" curriculum content knowledge was weak. It was also found that only professional qualification had a slight positive correlation with integrated science teachers" content knowledge of the integrated science curriculum. The results further indicated that majority of integrated science teachers generally adopted child-centred teaching practices at the introduction and evaluation stage of the lesson. The findings put the need of assigning teachers who have adequate science content knowledge to handle integrated science in Ghanaian Junior high school. It was recommended that in-service programmes, workshops, seminars and short courses should be organized for teachers by the Municipal Directorate of Education on the integrated science curriculum and SBA to improve teachers" knowledge of the integrated science curriculum and their skills in assessment practices.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter presents the introduction to the study. It comprises the background to the study, statement of the problem, purpose of the study and objectives of the study. it also presents the research questions, significance of the study, delimitation, limitations, and definition of terms. The chapter ends with organization of the study.

1.1 Background to the Study

Science is a subject that investigates nature, analyses societal problems and also provides some technological needs of the society. Some benefits of science and technology are that they have advanced the production of potent drugs and improved agricultural mechanization has led to high yield of crops and quality foodstuff to feed the ever-increasing population. In fact, communication and scientific methods of waste management have improved, greatly due to the application of scientific ideas. It is a well-known fact that the world is now witnessing an era of computer knowledge, science and technology development. This has led to the revision of the science curriculum of most countries.

Recent reforms in science education are aimed at preparing individuals to meet the challenges of the rapidly technological advancement of technology and to meet the demands of industrialization all over the world. This was evident in the 2007 educational reforms in Ghana which aimed among other things, to equip children with scientific literacy, positive attitudes and knowledge of basic science concepts that would provide a strong foundation for further study in science at Senior High school level and beyond. It is also to develop the young person interest and inclination toward the pursuit of scientific work through developing the spirit of curiosity, creativity and critical thinking (Curriculum Research and Development Division [CRDD], 2007). The acquisition of general scientific literacy by every Ghanaian citizen is a requirement for successful living in modern times.

Integrated science helps to raise the level of scientific literacy of the citizenry and equips them with the relevant basic integrated scientific knowledge needed for their own survival and for the development of the country. Students use critical thinking, self-assessment, reasoning, problem-solving, collaboration, research, and investigation to make connections in new and innovative ways as they progress through Integrated Science education (CRDD, 2012).

This scientific culture is the antithesis to superstition and a catalyst for faster development (CRDD, 2012). Integrated Science therefore cannot be underrated in this 21st Century when preparing students to be critical thinkers and to acquire skills to solve real-life problem.

In view of this the integrated science teachers need to have enough curriculum knowledge and adapt instructional and assessment practices to be able to implement the intended curriculum.

Pupil‟s performance in integrated science with reference to the current 2007 educational reform agenda requires teachers to utilize recommended instructional approach/ strategies that can facilitate pupils‟ science concepts formation (CRDD, 2007). This calls for teachers‟ knowledge on the curriculum and recommended teaching methods/strategies. This is because teachers‟ curriculum knowledge plays an important role in classroom practices. Teachers with low curriculum knowledge may not adapt to appropriate classroom practices which may actually be harmful to their students by passing on inaccurate ideas through inappropriate teaching materials (Ball & MacDiarmid, 1990). The reason is that curriculum knowledge entails knowledge of content and the corresponding teaching/learning materials and also consists of knowledge of how topics are developed across a given programme (Shulman, 1986).

A teacher with adequate curriculum knowledge is able to adapt to suitable instructional practices and effectively organize science classroom instruction. (Ako, 2017). The current teaching of science requires the Ghanaian science teacher to have enough knowledge in the science curriculum to have authority or power in the classroom and to play the role of a coach or facilitator who owns the pupils a duty to assist them in achieving the curriculum goals.

According to Showers (1990), for science to be effectively and properly taught, the practical approach to teaching must be viewed as an essential component of teaching integrated sciences. The "hands- on" approach has the potential to stimulate students‟ (pupils) interest in the subject matter, teaching laboratory skills enhance the learning of knowledge and give insight into scientific attitudes and objectives. Thus before this is achieved the integrated science teacher need to have pre requisite knowledge of the curriculum. However, evidence from the researcher‟s school shows that an appreciable proportion of JHS students lack conceptual understanding of a lot of the integrated science topics. An available record at Effutu Municipal Education Office also indicates that the performance of JHS student in science over the years has not improved as expected. In Effutu Municipality there is no prove to justify the cause of student low performance in the BECE, whether it is as a result of teachers‟ low curriculum knowledge or the instructional approaches utilized by the teachers during integrated science lessons. According to Mensah (2014), inappropriate teaching methods or techniques (instructional practices) used by some teachers have contributed to the poor performance of pupils in integrated science at JHS level. Although, there appears to be valid reasons to suspect that integrated science teachers in the study area are not teaching the subject as prescribed, no study has been found to investigate the issue. Information obtained from the Municipal office and some concern parents indicate that there has been a lot of complain from pupils in the study area about dissatisfaction with the general instructional approaches used by their teachers. Moreover, issues related to teachers" knowledge about what to teach, how to teach it, how students learn and what to assess may contribute to poor performance. (Mensah, 2014). For this reason, the study was designed to investigate JHS integrated science teachers" curriculum knowledge and instructional practices in view.

1.2 Statement of the Problem

A number of problems affect the teaching and learning of science at the Junior high school level in Ghana. There is some evidence that unworkable teachers" curriculum knowledge, instructional practices, lack of qualified teachers and in-service programme to address needs of teachers affect the teaching and learning of science (Ako, 2017). This has resulted in the abysmal performance of students in integrated science. There has been organization of extra classes/lessons for science students. Despite this, from 2011 to date the performance of JHS science students has not shown any improvement over the years in the Municipality (EMED, 2018). The BECE Integrated Science Chief Examiner"s reports have revealed that apart from a relatively low proportion of JHS pupils who perform credibly in the subject, most of the pupils did not do well in it (WAEC, 2014, 2015, 2016, 2017).

The weaknesses reported exceeded the strong points of the candidates. Although the Chief Examiner has been offering suggestions to address the candidates"" weaknesses, the situation appears to defy all attempts to be remedied. Perhaps teachers do not pay attention to the comments and suggestions from the chief examiner.

The Effutu Municipal Director of Education in her presentation at Educational seminar on the state of teaching and learning commented on the analyses of BECE results provided in Table 1.1.

Table 1. Effutu Municipal Analysis of BECE Integrated Science results from 2010-2017

Year	Number of Candidates	No of Pupils who Passed	% Passed
2011	896	549	61.3
2012	977	559	57.2
2013	1197	443	37.0
2014	1259	699	55.5
2015	1222	741	60.6
2016	1275	847	66.4
2017	1255	835	66.5

Source:(GES, Effutu Municipal 2018)

She lamented over the low pass rate of candidates in integrated science. She added that, low performance of pupils in integrated science called for public discourse.

Although concern has been raised by parents, teachers and other stakeholders about the performance of JHS students in science no discerning effort have been made to address the situation. In spite of the numerous recruitment of teachers to fill the gaps, the pupils‟ performance in integrated science has shown little significant improvement over the years.

A number of researchers have tried to find out the causes. For example, Appiah (2014) and Mensah (2014) conducted separate studies on science teachers‟ instructional practice and assessment practice, and Ako (2017) also conducted a research on natural science teachers‟ curriculum knowledge, self-Efficacy beliefs and classroom practices. But these studies were limited to lower primary of the research areas and this has left gaps in literature which the current study seeks to address.

Appiah (2014) and Ako (2017) were of the view that low level of teachers‟ knowledge in natural science curriculum and adoption of inappropriate instructional practices in the teaching and learning could hinder effective science instruction in their classroom. Though the studies were conducted at the lower primary similar observation may be applicable to science teaching at the JHS level. This is because basically integrated science teachers at the JHS level may have similar qualification with those at the primary school level. For this reason this study is designed in Effutu Municipality to determine the integrated science teacher‟s curriculum knowledge, instructional and assessment practices in teaching integrated science in the Effutu Municipality.

1.3 Purpose of the Study

The purpose of the study was to explore Effutu Municipal JHS integrated science teachers‟ curriculum knowledge, instructional and assessment practices they employed in their integrated science lessons.

1.4 Objective of the Study

The research was designed to:

1. investigate Effutu Municipal Junior High School integrated science teachers‟ knowledge on the Integrated science curriculum.
2. determine the relationship that exists between integrated science teachers‟ background factors and their content knowledge of the integrated science curriculum.
3. determine Effutu Municipal Junior High School integrated science teachers‟ instructional practices in the science classroom
4. examine Effutu Municipal Junior High School integrated science teachers‟ assessment practices in their science classroom.

1.5 Research Questions

The following research questions were formulated to guide the study:

1. What knowledge do Effutu Municipal Junior High School integrated science teachers have about the JHS science curriculum?
2. What relationship exists between integrated science teachers‟ background factors and their content knowledge of the integrated science curriculum?
3. What instructional practices do Effutu Municipal Junior High School integrated science teachers‟ use in their classrooms?
4. What assessment practices do Junior High School science teachers use in the classrooms?

1.6 Significance of Study

For any research to be useful it must contribute to the volume of existing knowledge of the field under investigation. In the view of this, it is my conviction that the information obtained from this study will provide additional information on some of the challenges that confront teachers in selection of suitable instructional approaches in teaching and learning of integrated science at the JHS level of education. It will also suggest remedies that will make students learning of science enjoyable.

It will also inform the Effutu Municipal Directorate of education and stakeholder in education on JHS science teachers Curriculum knowledge, instructional and assessment practices, and training needs of science teachers. This will also provide necessary information to Municipal Education Directorate that could be used to organize in-service training and workshop to address the challenges

1.7 Delimitations of the Study

Marilyn (2011) explained delimitations as those characteristics that limit the scope and define the boundaries of a study. According to him delimitations are in the control of the researcher. Delimiting factors may include the choice of objectives, the research questions, variables of interest, theoretical perspectives that the researcher adopted (as opposed to what could have been adopted), and the population he/she chooses to investigate. Although the study area included the Primary and JHS, the researcher restricted himself to only JHS. The study focused on Curriculum knowledge and instructional and assessment practices used by science teachers in the junior high schools in the Effutu Municipality. The study again restricted to JHS science teachers in both private and public schools in the Effutu Municipality which is one of the twenty districts in the Central region.

1.8 Limitation

The study like other research works, falls short of the ideal. Limitation in terms of the design, data collection procedure and data analysis were identified at each stage of this research work. Steps were therefore taken to minimize these limitations. The study used Census and purposive sampling techniques in order to include most of the variables of interest.

Limited resources did prevent a wider coverage of the entire Central Region of Ghana. The study was consequently based on the accessible sample in the Effutu Municipality despite the large number (21) of districts in the region. This procedure therefore decreased the generalization of the findings to the entire population (Central Regional integrated science teachers). The codification, organization and classification of the data collected for analysis and discussions were the most demanding in the research design. It was also particularly difficult to sieve all useful responses from the interviews and observations in categories for presentation and analysis. The categories identified in the study were therefore shaped by the researcher‟s perception, interpretation, and building of meaning of the data collected with guidance from the supervisor. This method of data analysis is not unusual as it remains typical of qualitative study (Patton, 2002).

1.9 Definition of terms

Integrated Science Teachers

Integrated science teachers are teachers who teach integrated science at JHS

Curriculum Knowledge

Curriculum knowledge refers to teachers‟ knowledge of the integrated science curriculum material, content, instructional approaches, as well as recommended assessment strategies outlined in the curriculum.

Instructional Practices

Instructional practices involve planning of lesson, organization of materials, and implementation of a lesson and evaluation of a lesson.

Teachers Assessment Practices

Teachers assessment practices includes all the information teachers gather in their classroom; information that helps them understand their students, plan and monitor their instructions, and establish available classroom culture as well as test and grade.

1.10 Organization of the Study

The study was organized into six chapters. Chapter one looked at the introduction of the study. It comprised the background to the study, statement of the problem, purpose of the study, research objectives and research questions. It also looked at the significance of the study, delimitation, and organization of the study. Chapter two involved review of literature relevant to the study while chapter three focused on the methodology which comprised the research design, population, sampling and sample size, instrument for data collection and the procedure used in data analysis. Chapter four dealt with results while chapter five dealt with discussion of findings. The final chapter involved the summary, conclusion and recommendations as well as suggested areas for further research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

The chapter reviews literature on teachers‟ science curriculum knowledge, which comprises science instruction and assessment. The review first explored the theoretical framework that underpins the study. Secondly, teachers‟ curriculum knowledge is reviewed; practices of instruction and assessment are reviewed. The chapter concludes with a summary of the main issues raised in the review.

2.1 Theoretical Framework

The theory underpinning this study is the Shulman‟s theory on Pedagogical Content Knowledge (PCK). Shulman (1986) introduced the concept of Pedagogical Content Knowledge as an element of knowledge base for teaching. Key elements in Shulmans‟ conception for PCK are knowledge of representations of the specific content and instructional approaches on the one hand, and understanding of learning difficulties and students‟ conceptions of specific content on the other. PCK involves the combination of content and appropriate pedagogy to understand how topics and issues are organized, represented and adapted to the diverse interests and abilities of learners for effective instruction (Shulman, 1987).

According to Shulman in (1986; 1987), fundamental to quality teaching is a teacher‟s use of pedagogical content knowledge (PCK). A special knowledge that teachers use to help students learn the subject matter as stated in Ward and Ayvazo (2016). In simple term, pedagogical content knowledge (PCK) is an “amalgam” of content and pedagogical knowledge (Shulman, 1986). Shulman (1986) introduced the concept of PCK in the field of teacher education and stated that teachers should have content knowledge of subject matter, pedagogical knowledge of subject matter and curricular knowledge. Shulman stated that PCK is a unique knowledge needed to transform several types of knowledge required for teaching and identified Subject matter content knowledge as a distinct component of it (Kumara, 2015). Again, Shulman (1986) explained that, the existence of high PCK level formed effective teaching. This indirectly made the students to understand the subject when the subject was delivered in an easier manner. As such, it is not surprising that PCK has been increasingly central to discussions about improving teaching since it was first proposed by Shulman in 1986. This can also be due to the fact that the quality of teaching students receive is widely understood to play a significant role in student learning (Toh, Ho, Riley, & Hoh, 2006).

In 1986, Shulman conceptualized PCK as one of three knowledge bases for teaching that included content knowledge and curricular knowledge. His widely quoted conception of PCK was defined as: "the ways of representing and formulating the subject matter that makes it comprehensible to others" (Shulman, 1986, p. 9). He further explained that PCK includes an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons. Shulman (1986) discussed PCK as a body of knowledge that informed three fundamental questions.

1. How teachers select content to be taught?
2. How they enact the content?
3. And, how teachers deal with students" misunderstanding?

According to Ward and Ayvazo (2016), Schulman in 1987 emphasized the role of PCK in addressing student needs, placing emphasis on what students bring with them into the educational setting such as their background (e.g., culture, social economic status), and particularly their prior knowledge (i.e., what students know and do not know about the content). Integrating these perspectives with his prior work, Shulman argued that PCK "represents the blending of content and pedagogy into an understanding of how particular topics, problems and or issues are organized, represented and adapted to the diverse interests and abilities of learners, and presented for instruction" (Shulman, 1987, p. 8).

Shulman"s intent in these first iterations was to draw the profession"s attention to the knowledge bases that underlie teaching. In particular, to differentiate among content knowledge, curricular knowledge and PCK. He also wanted to foreground the type of inquiry that might be pursued using this differentiation.

PCK has been widely used as a model for investigating of knowledge of teachers. PCK is related to the planning and instruction in the classroom and it forms part of professional knowledge base of teachers (Fernandez, 2014). Shulman stated that teachers" knowledge includes seven categories: Content knowledge, General pedagogical knowledge Curriculum knowledge, Pedagogical content knowledge, Knowledge of learners and their characteristics, Knowledge of educational contexts, Knowledge of educational ends, purposes, and values, and their philosophical and historical grounds.

Shulman (1986) defines curriculum knowledge as the understanding of the alternative form of curriculum for the teacher"s special area and the ways in which they are embodied in different texts and materials. Magnusson, Krajick and Borko (1999) also view science curriculum knowledge as knowledge of mandated goals and objectives of the curriculum and knowledge of specific curriculum programmes and materials.

Curriculum knowledge is characterized by the programmes designed for the teaching of a particular subject and topics at a given level of education, the variety of instructional materials available in relation to those programmes and characteristics that guides the use of those materials (Shulman, 1986). Magnusson, et. al (1999) stated that science curriculum knowledge consists of two categories: mandated goals and objectives, and specific curricular programmes and materials. While Shulman considered curricular knowledge to be a separate domain of the knowledge base for teaching (Wilson, Shulman, & Richert, 1988). Grossman (1990) asserted that it is part of pedagogical content knowledge because it represents knowledge that distinguishes the content specialist from the teacher which is stressed by pedagogical content knowledge.

Moreover, the curriculum and its related materials and pedagogy from which the teacher draws tools for teaching a particular content and assessment of the students" performance signifies teacher curriculum knowledge (Shulman, 1986). This implies that, teachers need to have understanding about the curriculum available for instruction, understand well the materials for that instruction, understand the pedagogical approaches and their alternative forms in dealing with misconceptions and varied abilities in the classroom (Ako, 2017). Another aspect of teachers" curriculum knowledge deals with knowledge of alternative curriculum materials, knowledge of students as well as knowledge of the content of the curriculum materials (Shulman, 1986).

According to Shulman, when teachers have adequate curriculum knowledge, of content structure of the subject matter and specific pedagogical approaches associated with the subject matter, they are likely to be more effective in their teaching. This suggests that, adequate curriculum knowledge of integrated science teachers will have optimistic effect on their classroom instructional practices.

Throughout much of the history of education, instruction has revolved around practices now termed “traditional” in nature. These instructional practices include lecture and teacher-led activities from a behaviourist theoretical framework (Woolfolk 2010). Because many instructors teach in the manner they were taught, traditional practices are still very common in classrooms today (Borko & Putnam, 1996). This situation is not different in the Ghanaian Junior High School science classrooms but the JHS science curriculum advises science teachers to avoid rote learning and drill-oriented methods and rather emphasize participatory teaching and learning in their lessons (CRDD, 2012). This in conformity with much advocated constructivist teaching approaches. Constructivist instructional practices are often student- centred instead of teacher -centred, providing students with the opportunity to be active participants in their own learning (Woolfolk, 2010). Practices from a constructivist perspective promote student construction of knowledge with broad applications for problem solving under more ambiguous conditions (Shulman, 1987). It is therefore appropriate for Ghanaian Junior High School science curriculum to recommend that “Teachers should help pupils to learn to compare, classify, analyse, look for patterns, spot relationships and come to their own conclusions/deductions” (CRDD, 2007). These instructing process call for a certain approach to classroom assessment practices in a constructivist classroom.

In a climate where learning occurs in context, constructivists propose that assessment should occur in context as well. Testing should be integrated into the task and not a separate activity (Merrill, 1991). In doing all of these things students must be able to work together in a group or multiple groups to achieve the ultimate goal while taking ownership of the learning and understanding the influences that shape it (Woolfolk, 2010). Woolfolk feather explained that, in questioning, teachers ask questions of students, and students ask questions of each other to learn more about a topic. It is more interactive than listening to teachers explain answers in a lecture. However, the questions must focus student attention, stimulate thinking, and result in learning. Assessment in Ghanaian Junior High School science classroom requires the use of objectives in the syllabus and should depend on profile dimension. But “It has been realized unfortunately that schools still teach the low ability thinking skills of knowledge and understanding and ignore the higher ability thinking skills” (CRDD, 2007).

Questioning can be used to hold attention, motivate students, and scaffold learning, so it is versatile and easily incorporated into other constructivist activities (Walsh & Sattes, 2005). Walsh and Sattes stated that quality questioning has four characteristics: a clear purpose, focus on content, facilitation of thinking at the appropriate cognitive level, and clear communication. Several types of questioning also exist, including Request and the Socratic Seminar. (Fisher, 1998). In Request (reciprocal questioning) students are taught to ask and answer questions of one another as they read. Initially the teacher may lead the process, but as students learn the process, they can perform the tasks on their own.

2.2 Related Literature

2.2.1 Science Teachers' Curriculum Knowledge

The word curriculum is derived from the Latin word "curere" which is literally translated as race course (Connelly & Clandinin, 1988). According to Carr (2002), curriculum is describe as all the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside the school. Curriculum experts have suggested a number of definitions each of which makes the learner view the concept from different perspectives. In his definition, Hirst (cited in Ako 2017) sees curriculum as "a programme of activities designed so that pupils will attain, as far as possible, certain educational ends or objectives" (p.40). This description reminds us of the fact that the curriculum of an institution is made up of all the activities that have been planned for pupils for the attainment of specific educational objectives. Wheeler (1983) states that curriculum is the planned experiences offered to the learners under the guidance of the school. This means a curriculum usually contains a statement of aims and specific objectives, indicates selection and organization of content, show certain patterns of learning and teaching finally it includes a programme of evaluation of the outcomes. Similarly, Taba (1962) posit that "Curriculum is after all, a way of preparing young people to participate as productive members of our culture" (p.10). Here the purpose is to provide the young generation with whatever knowledge, skills, attitudes and values that will enable them play the various roles that are demanded of them by the culture into which they are born.

Shulman (1986) presented a set of categories to describe alternative conception of curriculum. Shulman described curriculum under the following; Curriculum as content or subject matter, Curriculum as programme of planed activities, Curriculum as intended learning outcomes, Curriculum as cultural reproduction, Curriculum as experience, Curriculum as discrete tasks and concepts, Curriculum as agenda for social reconstruction and Curriculum as "currere"

Schubert cited in Appiah (2014) stated that although there are substantial differences among these categories, there is also considerable overlap in the sense that they pursue similar goals. It must be noted that the form of instruction and assessment implied in these different characterizations of curriculum could lead to quite different education. But in Ghana the nature of science curriculum is not different from that of Schubert, because Ghanaian JHS science curriculum contains content (subject matter to be taught), teacher and learner activities, modes of assessment, goals and specific objectives and process skills.

Shulman (1986) defined curriculum knowledge as the understanding of the alternative form of curriculum for (the teacher"s) special area and the ways in which those curriculum are embodied in different texts and materials. Magnusson (as cited in Appiah, 2014) summarises science curriculum knowledge in two ways. These include:

1. Knowledge of mandated goals and objectives
2. Knowledge of specific curriculum programmes and material.

There has been a lot of innovation in the integrated science curriculum till date, and a lot of research has been made in area of science teachers curriculum knowledge (Appiah, 2014, Ako, 2017), assessment in science classroom (Osei, 2004) and challenges in basic science education (UNESCO, 2010). However, it is amazing that so little attention has been paid to understanding junior high school teachers" knowledge of science curriculum.

There are studies that attempted to directly study teachers‟ knowledge of science curriculum but one notable exception is Treagust (1995) who found that knowledge of curriculum was an essential component of pre-service teacher pedagogical reasoning around lesson planning and instruction. Also, research in the area of teachers' existing science curriculum knowledge and its relationship to planning and instruction is limited (Abell & Lederman, 2007). In Ghana, the Junior High School science curriculum requires the teacher to study the syllabus carefully and plan ahead the activities the pupils will carry out during a particular lesson (CRDD, 2007).

In Ghana, the main goals of science teachers are to inculcates scientific literacy and scientific culture for all, so that people can make informed choices in their personal lives and approach challenges in the workplace in a systematic and logical order and also it aims to produce competent professionals in the various scientific disciplines who can carry out research and development at the highest level (CRDD, 2007).

Understanding teachers‟ knowledge of the curriculum and how it affects learners‟ performance, will be important for the future of science education research in Ghana.

2.2.1.1 Teachers' Knowledge about Goals, Objectives and Organization of Integrated Science Curriculum

According to Magnusson, Krajcik and Borko as cited in Ako (2017), an important category of the curricular knowledge component of pedagogical content knowledge includes "teachers‟ knowledge of the organization, goals and objectives for students in the subject(s) they are teaching, as well as the articulation of those guidelines across topics addressed during the school year" (p.9). It also includes the teachers‟ knowledge about rational for teaching integrated science, teachers knowledge of the organization of the content, and teachers‟ knowledge about the spiral curriculum in their subject(s). That is, what pupils have learnt in previous years and what they are expected to learn in later years (Grossman cited in Magnusson, Krajcik & Borko, 1999).

Schools have curriculum materials such as syllabus that indicate, for specific subjects, what concepts are to be addressed to meet national goals. Effective science teachers should be knowledgeable about these documents (syllabus) as well as the goals, objectives and how topics are organized in the integrated science curriculum (Magnusson, Krajcik & Borko, 1999).

The rationale behind the integrated science curriculum is to inculcate scientific literacy and scientific culture for all, so that people can make informed choices in their personal lives and approach challenges in the workplace in a systematic and logical order. To produce competent professionals in the various scientific disciplines who can carry out research and development at the highest level, and for meaningful scientific education, it is important for pupils to be trained in the investigative process of seeking answers to problems. This requires pupils to physically explore and discover knowledge within their environment and in the laboratory to be able to contribute new scientific principles and ideas to the body of knowledge already existing in their culture (CRDD, 2012). This requires integrated science teachers to have in depth knowledge on the goals and objectives of the curriculum to inform their instructional practices.

In addition, the syllabus for Junior High school integrated science covers three years of education. Each year"s work is organized under the five themes or sections. The themes are: introduction to Science, Diversity of matter (living and non-living things), Cycles, Systems, Energy and Interactions of matter (living and non-living things).

Under each theme or section are a set of units or topics. The knowledge, understandings as well as the activities and range of process skills presented in each theme have been extended at the different class levels (CRDD, 2012). Teachers teaching science should have enough knowledge in the teaching syllabus in other to organize lesson accordingly.

2.2.1.2 Science Teachers' Content Knowledge

Content Knowledge is knowledge about the actual subject matter that is to be learned or taught. Shulman (1986) defines content knowledge as the amount of subject matter knowledge in the mind of the teacher. According to Shulman, content knowledge goes beyond knowledge about facts and concepts. It includes knowledge of the structures of the subject and variety of ways in which the basic concepts and principles of the subject are organized. Thus, the teacher must understand the variety of ways of organizing the subject. "The teacher needs not only understand that something is so; the teacher must further understand why it is so, on what grounds its warrant can be asserted, and under what circumstances our belief in its justification can be weakened and even denied" (Shulman, 1986, p.9).

Magnusson, Krajcik and Borko (1999) posits that Knowledge of specific curricular programme as a category of teachers‟ knowledge of curriculum consists of knowledge of the programmes and materials that are relevant to teaching a particular domain of science and specific topics within that domain. This means that, integrated science teachers should be knowledgeable about the content of the integrated science curriculum content as well as the activities and materials to be used in teaching those contents. Magnusson, et.al (1999) further indicated that knowledge of requirements for learning consists of "science teachers‟ knowledge and beliefs about prerequisite knowledge for learning specific scientific knowledge, as well as their understanding of variations in students‟ approaches to learning as they relate to the development of knowledge within specific topic areas" (p. 10). Teachers‟ knowledge of prerequisite knowledge required for students to learn specific concepts includes knowledge of the abilities and skills that students might need to successfully learn specific subjects or topics.

Diamond, Maerten-Rivera, Rohrer and Lee (2013) propose that teacher CK can have a direct effect on student learning and indirect effect on PCK. Studies however suggest that JHS school teachers tend to have major gaps in their integrated science curriculum Content Knowledge (SCK) and that these gaps are a major obstacle to effective teaching (Nowicki, Sullivan-Watts, Shim, Young, & Pockalny, 2013). This is largely due to poor science preparation in pre-service teacher programmes (Diamond et, al, 2013) and inadequate in-service training for practicing teachers (Leu & Ginsburg, 2011). Kahan, Cooper and Bethea (2003) stated that researchers frequently conclude that students would learn more science if their teachers knew more science. However, "content knowledge in the subject area alone does not suffice for good teaching" (p.223).

Though, Kallery and Psillos (2001) found that teachers‟ content knowledge influenced the way in which they represented the content to students. Researchers have established that teachers may feel uncomfortable teaching science to children due to their lack of content and pedagogical knowledge. This would hinder their ability and motivation to create meaningful science experiences for children (Watters, Diezmann, Grieshaber, & Davis, 2001; Fayez, Sabah, & Oliemat, 2011). Garbett (2003) and Hedges (2003) suggest that it is essential for teachers to develop vast science content knowledge base to support children‟s scientific thinking. Hedges and Cullen (2005) highlight that, “teachers having sufficient breadth and depth of content knowledge are able to respond meaningfully to extend children‟s interests and inquiries” (p. 20). They stated that it is “likely that teachers‟ beliefs and their lack of content knowledge will impact on the curriculum provided for children and on the teachers‟ ability to effectively construct knowledge with children” (p.16).

Some studies have highlighted the prevalence of both in-service and pre-service teachers‟ misconceptions and the potential negative impact of this on their teaching of the often complex scientific (Garbett, 2003; Liston, 2013). A study conducted by Garbett (2003) revealed that pre-service teachers‟ content knowledge in science was generally poor. Also, it has been shown that high percentages of pre-service teachers enter the teaching profession with similarly inaccurate conceptions of science (Murphy & Smith, 2012; Liston, 2013). According to Tekkaya, Cakıroglu and Ozkan (2004), even though pre-service primary teachers often feel confident in their teaching of science, they can have poor understanding of scientific concepts. Appiah (2014) found that majority of JHS teachers had inadequate science curriculum content knowledge and also admitted they encountered some difficulties when teaching some topics in science. JHS teachers‟ inadequate content knowledge and understanding of science therefore may affect their teaching methodologies and their ability to teach science effectively (Murphy & Smith, 2012; Harlen, 2013). Other Researches on teacher content knowledge indicates that teacher‟s knowledge of subject content influences the teacher‟s instructional practices across subject areas and at different grade levels (Brophy, 1998; Lee, 1995; Shulman, 2000). Teachers with inadequate content knowledge rely heavily on the textbook as the primary source of subject matter content (Feiman-Nemser, 2001) and tend to minimize students‟ participation in a class discussion. This means that teachers" content knowledge and pedagogy shape how the teacher might respond to students" questions and inquiries as the lesson unfolds in the science classroom (Crawford, 2007). Also, if the teachers" knowledge of other curricular demands are inadequate to meet the new content associated with curriculum innovations, then they may be reluctant to implement it (Ngman-Wara, 2011).

2.2.1.3 Science Teachers' Pedagogical Knowledge

Pedagogical Knowledge (PK) is knowledge about the processes and practices or methods of teaching and learning. Shulman (1986) defines pedagogical knowledge as knowledge of generic principles of teaching and classroom organization. According to Shulman, pedagogical knowledge is a major category of teacher knowledge together with content knowledge. It encompasses knowledge of educational purposes, values, aims, and more. It is a generic form of knowledge that applies to student learning, classroom management, lesson plan development and implementation, and student evaluation. It also includes knowledge about techniques or methods used in the classroom; the nature of the target audience; and strategies for evaluating student understanding. A teacher with deep PK understands how students construct knowledge and acquire skills in different ways, and how they develop habits of the mind and dispositions toward learning. As such, pedagogical knowledge requires an understanding of cognitive, social and developmental theories of learning and how they apply to students in the classroom (Shulman, 1986). This makes PK "tools of the trade" and every teacher is required to possess it. This also means that student-teachers should be trained to possess this form of knowledge.

Ako (2017), states that Ghanaian science classroom is typically made up of pupils with diverse abilities and needs which constitute a complex social framework within which learning takes place. These diverse abilities and need of pupils in the classroom pose various challenges to teachers, who have to know how to structure and organize learning opportunities accordingly. Also, pupils‟ learning outcomes are determined largely by the characteristics of individual students in terms of the differences in their prior knowledge and preconceptions as well as in their motivational orientations. Science teachers need knowledge of how this diversity in the classroom can be properly handled to ensure insightful learning of pupils (Voss, 2014).

Teachers should know how to teach their students by focusing on subject matter, content, and incorporated pedagogy to achieve classroom objectives. This means that a transformation of teachers‟ knowledge from a variety of domains of knowledge, which includes subject matter knowledge, pedagogical knowledge, and knowledge about content of the curriculum is necessary for effective instruction (Botha & Reddy, 2011). Therefore, there is a need for integrated science teachers to combine knowledge in content and pedagogy to effectively instruct integrated science in their classrooms. Integrated science teachers‟ general content knowledge, pedagogical knowledge, knowledge of curriculum materials as well as knowledge of aims and objectives of the integrated science curriculum are essential aspect of implementing the integrated science curriculum, there is a need to examine how the interchange of these aspects of the teachers‟ knowledge affects their classroom instructional practices.

2.3 Science Teachers' Instructional Practices

JHS Integrated Science teachers are important participants of integrated science teaching process. In Ghana, the recommended instructional approach for science teaching and learning is child centred instruction. The integrated science curriculum puts more emphasis on inquiry process of science instruction which is learner centred instructional strategy. Inquiry based instruction by National Research Council (NRC) as cited in Appiah (2014) is defined as a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in the light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, predictions and communicating the results. In view of this, it is suggested that pupils who studied integrated science and mathematics at Basic 4-6 have the pre requisite skills for effective study of JHS integrated science (CRDD, 2012). Inquiry based science is a powerful vehicle for developing such individuals. It promotes understanding about nature of science, the acquisition of scientific knowledge and skills, and the cultivation of scientific habits of mind. It enables pupils to learn science content and use scientific understanding to make decision about personal and social issues.

For science to be effectively and properly taught, the practical approach to teaching must be viewed as an essential component of studying integrated science. The "hands-on" approach has the potential to stimulate students" (pupils) interest in the subject matter. Also teaching laboratory skills enhance the learning of knowledge and gives insight into scientific attitudes and objectives. It also gives the students the opportunity to learn and practice all the activities involved in the inquiry processes of science.

Miles (2015) asserted that it is expected of a teacher to implement a range of instructional strategies that will bring academic success to all the science students. For any method to be able to bring good result in the present age, it should be a method that promotes maximum social interaction. In view of this the instructional approaches in teaching and learning integrated science should be child centred which has multiple instructional strategies that can be adapted in teaching science in Ghanaian science classroom. However, teacher–centred method is prominent in JHS science classroom in Ghana**.** However, teacher-centred method is prominent in JHS science classrooms in Ghana. These two method (child-centred and teacher centred are discussed. (Ngman –wara, 2015).

2.3.1 Child-Centered Instruction

The child-centred approach is defined by Mayer, cited in Barbara (2007) as a learning process whereby learners work individually or in small groups to explore, investigate, and solve authentic problems and become actively engaged in seeking knowledge and information rather than being passive recipients. She continues to assert that, in traditional learning mode, the teacher basically controls the instructional process. The content is delivered to the entire class, and the teacher tends to emphasis factual knowledge, and the focus of learning is on the content, that is how much material has been delivered, and how much have students learnt. This shows that this traditional rote memorisation learning mode tends to be passive and learners play little part in the learning process.

Mayer cited in Barbara (2007) asserted that in the learner centred approach, learners play an active part in the learning process. They become autonomous learners who are actively engaged in constructing meaning within the context of their knowledge, experiences and social environments. She continues to say that learners become successful in constructing knowledge through solving problems that are realistic, and they usually excel when they work collaboratively with others. All this means that the child-centred approach is learner-centred as opposed to teacher dominated.

Child-centred instruction is also viewed as an instructional approach in which students influence the content, activities, materials, and pace of learning. This learning model places the student (learner) in the centre of the learning process (Collins & O'Brien, 2003). With this type of instruction, the instructor provides students with opportunities to learn independently and from one another and coaches those of the skills they need to do so effectively.

Child-centred instruction means that students assume a certain degree of responsibility for what is taught and how it is learned. There is a slant towards experiential learning and making discoveries for themselves (Martin, 2001). Studies elsewhere suggest that child-centred learning can also be viewed from the perspective of an influential report that synthesized research on learning and recommended organizing learning environments around four foci: knowledge-centred, learner-centred, assessment-centred, and community-centred. (National Research Council, 1996). To explain the foci in detail, knowledge-centred learning approaches grow out of the research on novices and experts that has revealed that experts organize their own knowledge very differently than novices, so knowledge-centred learning stresses learners developing their knowledge to facilitate transfer of their learning to new contexts and application of their learning to open-ended challenges such as problem-solving, critical thinking, and design. Similarly, Ghana junior high school science curriculum recommends that teachers should help pupils to learn to compare, classify, analyse, look for patterns, spot relationships and come to their own conclusions /deduction (CRDD, 2007). Although teachers may find student-centred learning approaches to be more enjoyable and lead to improved student learning, they still have questions about the amount of content that can be covered using the approach (Tien, 2011). Content coverage is still high priority for teachers, more especially Ghanaian science teachers. Answers to whether science teacher can cover the same or more content with student- centred learning approaches as compared to traditional lecture-based approaches depend on individual teachers (Osei, 2004). Osei cited in Ako (2017) indicated that some Ghanaian science teachers indicate that they cover as much or most content with student-centred learning approaches while some adopters of student-centred learning approaches indicate that they now cover less content than when they exclusively lectured, but that students are learning more.

Child-centered instructional strategies promote deep and lasting learning (Fahraeus, 2013). This process emphasizes need, requirement, interest and capability of students. The students are active participants where their skills and abilities are developed. Teacher and students jointly explore the different aspects of problem. The role of the teacher is to create a problematic situation, have materials and resources available to the students, and help them identify issues, state hypotheses, clarify and test hypotheses and draw conclusions.

In learner-centred teaching, teachers do not employ a single teaching strategy but use different types of instructional strategies that shift the role of the instructors from givers of information to facilitators of students" learning (Blumberg, 2008). Carmichael (2009) noted that teaching strategies that promote student involvement and which students find meaningful will hold students" interest.

According to Schweisfurth (2013), child-centered teaching is a solution to a myriad of problems including: a narrow examination-focused orientation in teaching, the need for inclusion of all learners, the need for a democratic political culture and the need to solve the problem of poverty and elitism.

A summary of the advantages Child-centred teaching has been made, according to Vavrus, et al. (2011), and American Psychological Association (APA). In total, APA has developed 14 learner-centred principles that highlight some of the benefits that are believed to result from high-quality learner-centred instruction in the classroom. The most relevance principles include:

1. The successful learner, over time and with support and instructional guidance, can create meaningful coherent representations of knowledge
2. The successful learner can link new information with existing knowledge in meaningful ways
3. The successful learner can create and use repertoire of thinking and reasoning strategies to achieve complex learning goals
4. Higher-order strategies for selecting and monitoring mental operations facilitate creative and critical thinking
5. The learner"s creativity, higher order thinking, and natural curiosity all contribute to motivation to learn. Intrinsic motivation is stimulated by tasks of optimal novelty and difficulty, relevant to personal interests, and providing for personal choice and control

According to Shulman (1987), pedagogical reasoning is linked to the practical aspect of teaching through teachers" comprehension of purposes, subject matter structures, and the ability to transform these through stages of preparation, representation, selection and adaptation.

Appiah (2014) asserts that empirical evidence has proven that there are many child centred teaching methods in teaching science that teachers can use in class. Which method to use is determined by a number of factors, for example availability of resources, the topic being covered, calibre of learners, as well as the teachers" expertise and experience on particular methods. It is therefore important for integrated science teachers to choose an appropriate method for the lesson than to choose for the sake of choosing.

Authorities such as McInnis (2000), Burdett (2003), Erickson (2007), and others, suggested the following child centred methods and strategies to teaching and learning in classrooms; inquiry based method, activity–based method, demonstration, brainstorming, project work, using ICT, discussions experiment or laboratory teaching etc.

UNICEF (2014) indicated that pupils should be made to understand the purpose of the lessons and activities in order to motivate them to learn. In implementing child-centered instructional approach, it is important that teachers link what is taught and how it is taught to the daily lives of the children. Teachers should therefore make an effort to connect with their pupils, know what is important for them and create a relaxed atmosphere in which students feel safe to exchange with each other and the teacher. Also, child-centered instruction demands that lessons build on previous knowledge and skills of students and use daily experiences of the children as examples when explaining new concepts (UNICEF, 2014). This can be done when children are encouraged to bring things from home and share their stories and experiences in class.

2.3.2 Teacher-Centred Instruction

Teacher-centred approaches are more traditional in nature, focusing on the teacher as instructor. They are sometimes referred to as direct instruction, deductive teaching or expository teaching, and are typified by the lecture type presentation. In this method of teaching, the teacher controls what is to be taught and how students are presented with the information that they are to learn. (Hill, 2005).

In the teacher-centered approach to instruction, development of curriculum and control of the learning process. is retained by the teacher and is closely related to the behaviourist tradition. The teachers" role is to create an environment which stimulates the desired behaviour and discourages behaviours that are believed to be undesirable (Liu, Qiao, & Liu, 2006). In other words, teachers control the learning situation to obtain the desired outcome, guided by generalized characteristics of the learners (Wagner & McCombs, 1995).

Traditional teacher-centred instruction is generally defined as a style in which the teacher assumes primary responsibility for the communication of knowledge to students. (Mascolo, 2009). From this view, teachers command greater expertise about the subject matter. They are in the best position to decide the structure and content of any given classroom experience. Teacher-centred instruction is usually understood to involve the use of the lecture as a primary means of communication in the classroom. In Ghana, the goal of the classroom involves the dissemination of a relatively fixed body of knowledge that is determined by the teacher. The lecture format is generally assumed to proceed in an independent fashion; the teacher elaborates upon a given body of knowledge from his or her own expert perspective rather than building the content of classroom communication around questions that students might have (Mascolo, 2009).

Mascolo (2009) stated that teacher-centred pedagogy is often described as being based upon a model of an active teacher and a passive student. At this point it is useful to operationalise what is meant by teacher and student-centred instruction. Teacher-centred instruction means that the teacher controls what is taught and under what conditions. Someone who enters a classroom with teacher centred instruction would be able to identify the following elements:

1. Teacher talk exceeds student talk during instruction;
2. Instruction is mostly with the entire class;
3. Textbooks guide what is being taught in class;
4. Each episode within the lesson is determined by the teacher;
5. Desks and chairs are usually arranged into neat rows facing the chalkboard;
6. Students‟ are not free to roam from their seats.

The question many Ghanaian educators asked is why is one particular tradition flourishing so well, while the other has not taken off? The persistence of the teacher-centred approach by virtue of such traditions may not be encouraged in western countries but is well encouraged in Ghanaian science classrooms. The reason is one which may be attributed to performance orientation of Ghanaian society at large where examination is the only way to assess pupils‟ performance. This makes Ghanaian classrooms dominated with teaching practices that concentrate on definite content and skills that have to be learnt in order to pass examinations. (Appiah, 2014)

With such an orientation there is the tendency of students to prefer teachers giving them the relevant information in an authoritative way rather than allowing them to discover on their own. On the contrary, the Ghana science curriculum advices teachers to avoid rote learning and drill-oriented methods and rather emphasize participatory teaching and learning in science Lessons (CRDD, 2007).

Ghanaian science classrooms are generally filled with the dissemination of a relatively fixed body of knowledge that is determined by the teacher (Anamuah-Mensah, Akwesi-Asabere & Mireku, 2004). The teacher elaborates upon a given body of knowledge from his or her own expert perspective rather than building the content of classroom communication around questions that students might have (Voss, 2014). According to Achuonye (2015), traditional teaching methods are characterized by teacher centredness, content-laden, passivity of learners, rote learning, shallow-learning and examination oriented learning. The predominant teacher-centred instructional approach used by Ghanaian science teachers is the lecture method (Ngman-Wara, 2015) which is also called telling or talk-chalk method. Ajelabi (2000) observed that teacher-centered method is probably the oldest well known and widely used method, still commonly practiced at all levels, and teachers find it very convenient to adopt. Achuonye (2015) also confirmed that teacher-centered instructional approach is still the predominantly used teaching strategy at primary, secondary and tertiary institutions. Achuonye acknowledged that teacher-centred approach is still much on top of the list of teacher‟s instructional approaches because it covers a large amount of information in a short time.

2.4 Teachers Knowledge of Assessment in Science Curriculum

Assessment is the progression of collecting, analysing and interpreting information on teaching and learning to aid in decision making (Airasian, 1996). According to Airasian, (cited in Appiah, 2014) assessment includes all the information teachers gather in their classroom; information that helps them understand their students, plan and monitor their instructions, and establish available classroom culture as well as test and grade. In view of this, assessment is a mechanism for providing instructors as well as pupils with data for improving their teaching and learning.

Assessment can also be view as the process of gathering and interpreting evidence of learning to make informed judgments and decisions about how well students are progressing. The National Research Council [NRC] (1999) defines assessment as a process of collecting and interpreting evidence of student progress to inform reasoned judgments about what a student or group of students knows relative to the identified learning goals. It involves the generation, collection, interpretation and communication of data for some purpose (Harlen, 2013). Therefore, assessment is a primary mechanism for feedback on the attainment of standards to pupils and teachers, as well as to parents, the school and the community. Assessment is an influential and strong process that can optimize or inhibit learning, depending on how it is undertaken in the classroom. This is why assessment, teaching and learning are said to be inseparably linked, as each informs the other (Calveric, 2010). Researchers estimates that, classroom teachers spend up to about fifty percent of their instructional time on assessment-related activities (Stiggins, as cited in Calveric, 2010).

Oduro (2015) found that both formal and informal assessments were practiced by Ghanaian basic school teachers. The formal assessments included class exercises, quizzes, tests, and homework and end-of-year/course examinations whereas; the informal assessments included asking questions orally as well as monitoring of pupils‟ work during teaching. The teachers did not view assessment just for assigning pupils grades but also, for other purposes as well. For example, assessment results were used as a means of improving teaching. Oduro (2015) also indicated that teachers were not using open-ended assessment items in their assessment. Titty as cited in Ako (2017) found that primary school teachers were to some extent able to plan their formative assessment. He further indicated that, most teachers did not design desirable classroom assessment instruments which have the potential of promoting critical and logical thinking, problem-solving strategies among others in their pupils.

Teachers knowledge of assessment in integrated science remains one component of pedagogical content knowledge, which was originally proposed by Tamir as cited in Ako 2017 as teachers‟ knowledge of the aspects of students‟ learning that are important to assess within a particular unit of study and knowledge of the methods by which that learning can be assessed. In view of this, teachers need to have enough knowledge in new assessment methods as stated in the new curriculum (CRDD, 2012). With the introduction of School base assessment, which form part of the innovation of the integrated science curriculum, teachers who are the main implementers of the curriculum need to have enough knowledge in other to make it implementation a success. The recommended forms of assessment in the integrated science curriculum are formative assessment and summative assessment as well as the School Based Assessment (SBA).

> *"Teachers' knowledge of methods of assessment includes knowledge of specific instruments or procedures, approaches or activities that can be used during a particular unit of study to assess important dimensions of science learning, as well as the advantages and disadvantages associated with employing a particular assessment device or technique" (Magnusson, Krajcik & Borko, 1999, p.15).*

Integrated science teachers" assessment practices therefore requires how the teachers are able to implement all assessment strategies efficiently to create the needed data which will help expand their classroom practices for effective learning among their pupils. Despite the introduction of the school based assessment in 2008, Junior high school science teachers still use continuous assessment. (Appiah, 2014). If learning is defined as construction or acquisition of new knowledge, then teachers should be particularly concerned with how the process is managed and not how it is evaluated. Assessment is an integral and essential component of quality teaching and learning in science (Goodrum, 2001) and for enhancing the achievement of scientific literacy (National Research Council, 1996). Assessment as understood by many is regarded as a way of grading and reporting students" performances to their parents (Goodrum, 2001). On the contrary Cooper and McIntyre (1996) note that assessment is not just about grading and reporting but rather a continual diagnosis of student learning and development. Therefore, assessment is not about stopping teaching and testing students as it is being practiced in Ghanaian science classroom but rather a constant, ongoing, embedded practice as teachers instruct and facilitate learning should be daily occurrence in all classrooms (Appiah, 2014)

2.4.1 Integrated Science Teachers Practice of Formative Assessment

Formative assessment is defined as any task that creates feedback for students about their learning (Irons, 2008). It is also delineated as "an ongoing assessment" (Clarke, 2005: p.10) based on how well students fulfill learning, and engages students in improving their learning. The central principle behind formative assessment is to "contribute to students" learning through the provision of information about the performance" (Yorke, 2003: p.478). Black and William (1998) offer a broad definition of formative assessment by stating it is "all those activities undertaken by teachers and/or by their students which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" (p.7-8). The main use of data in formative assessment is to help in student learning. It is therefore referred to as assessment for learning. Assessment for learning is based upon an understanding of student motivation and the psychology of learning, so students become better learners for the rest of their lives as a result of their successful learning experiences. Assessment for learning makes a difference for students, it also results in a more satisfying and enjoyable experience for teachers. Teachers become more aware of how students learn and become more engaged with students in the learning process, helping them to set goals and criteria, evaluate their progress, and experience that many small "wins" lead to them by reaching their goals. The focus is on monitoring student response to and progress with instruction. It provides immediate feedback to both the teacher and student regarding the learning process and therefore forms an integral part of the instructional process as it helps the teacher and students to identify how they are progressing,

Harlen cited in Ako (2017) identifies six key components of formative assessment. These key components help to clearly define how formative assessment should be carried out in science classroom. The six key components are explained below: In formative assessment, students are engaged to express and communicate their understandings and skills through dialogue, initiated by open-ended and person-centred questions. The teacher also creates a classroom culture where students allowed communicating their understanding and asking questions about concepts being delivered and learnt and also about procedures being used. The teacher must ask open-ended questions that will demand students to think deeply about concepts and procedures. Responses from these open-ended and person-centred questions help the teacher to determine how students are thinking critically about the entire learning process and make the necessary adjustments where necessary. In other words, teachers use questions to generate evidence of students" ideas and to help develop these ideas. Teachers also use feedback from students to regulate their teaching and how students learn. This can be achieved when teachers have clear goals they want students to achieve at the end of a lesson. The teacher collects evidence when students are involved in investigations, by observing, questioning, listening to how students are using words and studying books.

Integrated science teachers are expected to provide feedback to students that provide advice on how to improve or move forward and avoid making comparisons with other students. However, in the classroom teachers provide quick and effective feedback to students on how they are performing in their learning. A teacher provides oral or written feedback to student discussion or work. For example, a teacher responds orally to a question asked in class; provides written comment in a response or reflective journal, or provides feedback on student work.

Stiggins (2002) also argues that when teachers use assessment for learning, they provide information for students to advance, rather than merely checking on student learning. However, formative form of assessment is rarely practiced by science teachers in Ghanaian public schools (Appiah, 2014). This is because teachers are always in a hurry to complete the syllabus. It is important that teachers use techniques such as observation and classroom discussions alongside analysis of tests and homework to provide feedback on pupils" learning and to improve their classroom instruction.

2.4.2 Science Teachers Practice of Summative Assessment

Summative assessment normally takes place at the end of courses. A suggested by Torrance and Pryor (2002), "summative assessment is generally considered to be undertaken at the end of a lesson or programme of study in order to measure and communicate pupils" performance and (latterly) accountability" (p.8). Its primary emphasis is to make a judgement about the learning that has occurred Summative assessment is normally referred to as assessment of learning, in which the focus is on determining what the student has learnt at the end of a course (Harlen, 2013). In other words, summative assessment refers to assessment carried out for the purpose of reporting achievement at a particular time. It helps to determine to what extent the instructional and learning goals and objectives have been met. While summative assessment is not intended to have direct impact on learning as it takes place, it nevertheless can be used to help learning in a less direct but necessary way because it provides a summary of students" learning to inform the next teacher when students move from one class to the next or from one school to another. It also enables teachers, parents and the school to keep record of students" learning, both as individuals and as members of a group or class (Harlen, 2013).

Summative assessment employs a variety of tools and methods for obtaining information about what has been learned. In this way, summative assessment provides information at the student, classroom, and school level. Summative assessment informs instructional practice in several ways. It serves both as a guide to teaching methods and improving curriculum to better match the interests and needs of students. Harlen identifies six key components of summative assessment. These key components help to define the practices of summative assessment in the integrated science classroom.

Defining characteristics of effective summative assessment include clear alignment between assessment, curriculum, and instruction, as well as the use of assessments that are both valid and reliable. The teacher involves students in special tasks or tests as part of, or in addition to, regular work. Thus, information from projects, tests, exercises, artefacts, student portfolio, class presentations as well as evidence about performance in relation to relevant understanding and competencies should form part of summative assessment. (Harlen, 2013). This is usually effective in „internal" summative assessment. Thus, summative assessment is undertaken by the teacher, for example, mid-term or end of term examination.

External examination bodies also conduct end of programme examination such as Basic Education Certificate Examination (BECE) and West African Senior Secondary School Certificate Examination (WASSCE). (Ako, 2017).

2.4.3 School Based Assessment (SBA)

School Based Assessment (SBA) was introduced into the school system in September 2008. SBA, which replaced the continuous assessment is a very effective system for teaching and learning if carried out properly. According to the CRDD (2012), the new SBA system is designed to provide schools with an internal assessment system that will help schools to achieve the following purposes to:

1. provide a reduced but more effective system of internal school assessment replacing the former Continuous Assessment system which was rather tedious for both teachers and pupils/students
2. standardize the practice of internal school assessment throughout the country
3. provide teachers with guidelines for constructing assessment items/questions
4. provide teachers with advice on how to conduct remedial instruction to improve pupil/student school performance
5. provide guidance in marking and grading test items and questions and carry out general appraisal of pupil/student performance

The previous continuous assessment begun in 1987 as a method of evaluating the progress and achievement of students in educational institutions (Ako, 2017). Continuous assessment marks and external examination scores were used to determine the final grade of students at the end of their programmes (BECE, WASSCE). This mode of assessment was abandoned because as stated by the GES Assessment Services Unit (ASU, 2008), the work involved in computing CA marks appeared cumbersome for teachers. They experienced difficulty in the large number of assessments pupils have to go through and the larger number of mark recordings they have to make. Also, it had limited number of projects works to make pupils apply their knowledge to produce something practical. The introduction of project work was due to number of pupils in a classroom. The continuous assessment therefore was replaced due to cumbersome assessment tasks and lack of uniformity and accuracy of assessment tasks in schools across the country (CRDD, 2012). Science teacher are encourage to use SBA instead of the old continues assessment.

Despite the introduction of the school based assessment in 2008, junior high school science teachers still use continuous assessment (Appiah, 2014). If learning is defined as construction or acquisition of new knowledge, then teachers should be particularly concerned with how the process is managed and not how it is evaluated. Therefore, assessment is not about stopping teaching and testing students as it is being practiced in Ghanaian science classroom but rather a constant, ongoing, embedded practice as teachers instruct and facilitate learning should be daily occurrence in all classrooms.

2.5 Summary

In summary, Shulman (1986) introduced the concept of Pedagogical Content Knowledge as an element of specific knowledge base for teaching. PCK involves the combination of content and appropriate pedagogy to understand how topics and issues are organized, represented and adapted to the diverse interests and abilities of learners for effective instruction (Shulman, 1987). Shulman proposed seven categories knowledge: a. content knowledge, b. general pedagogical knowledge, c. curriculum knowledge, d. pedagogical content knowledge, e. knowledge of learners and their characteristics, f. knowledge of educational contexts, g. knowledge of educational ends, purposes, and values, and their philosophical and historical grounds.

Integrated science teachers must select instructional approaches recommended by the science curriculum. Science curriculum emphasized child-centred instructional approaches to science teaching to promote active learning of pupils. Researchers suggest that teachers with high curriculum knowledge play a role in determining how teachers approach their teaching while curriculum knowledge also determines teacher‟s instruction. Curriculum knowledge plays is likely to influence the type of instructional approach they will adopt in their teaching.

Improving instructional practice can greatly improve student performance (Bybee, 2006). Teachers" instructional practices must engage students in learning, build upon students" prior knowledge, have a relevant context and framework and organized appropriately. Ultimately these practices must lead students to define goals of the curriculum and monitor progress in attaining the goals. Subject matter must be taught in depth and misconceptions cleared up immediately via a focus on metacognitive skills (Bybee, 2006).

The literature emphasised that teachers must accurately assess student needs and choose practices to support learning and challenge thinking. Therefore assessment must be an integral part of instruction. Reflection upon learning through writing, projects, portfolios, and other strategies is important. Constructivist instructional practices such as cooperative learning, presentations and other performance-based assessments such as portfolios/laboratory notebooks, writings, and independent research projects are highly recommended for effective teaching and learning.

Integrated science teachers need to understand what pupils know or do not know for effective teaching. Therefore they need to assess their pupils before and during instruction. The Recommended assessment approaches in the integrated science curriculum are aggregated in the School Based Assessment model. The SBA includes among others, school projects that are intended to give pupils the opportunity to apply their learning in practical terms to develop new ideas, new processes and new products. They will also acquire critical thinking skills and habits that will help them in their future careers and in their personal lives.

CHAPTER THREE

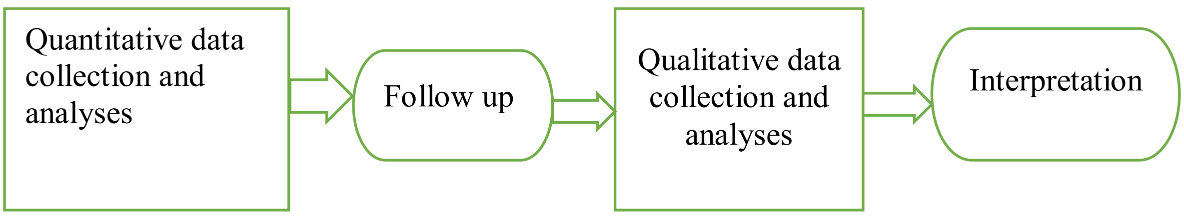
METHODOLOGY

3.0 Overview

This chapter provides detailed description of the methodology employed to collect data for the study. It includes the research design, population and setting of the study, sample and sampling procedures, research instrument and data collection procedures. It ends with data analysis.

3.1 Research Design

A research design is a plan or blueprint of how one intends to conduct research (Thyer; cited by Mouton, 2001). Furthermore, Huysamen, cited by Fouche and De Vos (1998), refines this definition by specifying that "this plan, or blueprint offers the framework in accordance with which data are to be collected to investigate the research hypothesis or question in the most economical manner". Sequential Explanatory mixed method design was used. It involves a two-phase project in which the researcher collects quantitative data in the first phase, analyzes the results, and then uses the results to plan (or build into) the second (qualitative) phase (Creswell, 2014). (fig.1)



Source: (Creswell, 2014)

Figure 1: Explanatory Sequential Mixed Method Design

This study adopted the mixed method because the researcher used questionnaire as a main instrument to collect quantitative data on integrated science teachers‟ curriculum knowledge, which involves; science teachers content knowledge, science teachers pedagogical knowledge, teachers knowledge of the goals, objectives and organization of the science curriculum, teachers instructional approaches and teachers knowledge of assessment in science curriculum of the teachers in the Effutu Municipality which is followed by observations to determine teachers" instructional practices utilize in the classroom. Interview was used to explore integrated science teachers curriculum knowledge and instructional approaches used in teaching science. The qualitative data (classroom observation and interview) then strengthened the quantitative data obtained from the questionnaires.

Using the mixed method research approach for a study provides strengths that offset the weakness of both quantitative and qualitative research approach and provides more comprehensive evidence for studying a research problem than either quantitative or a qualitative research approach alone (Creswell, 2008).

3.2 Setting

The research was conducted in the Effutu Municipality in the Central Region of Ghana (Fig. 2). The population of Effutu Municipality, according to the 2010 Population and Housing Census, is 68,592 which represents 3.1% of the region"s total population of 2,201,863 with males and females representing 48.8% and 51.2% respectively (Ghana Statistical Service, 2014). The Municipality is characterized by a youthful population since one-third of the population fall below the ages 15 years. Majority of the adult population (31.4%) are engaged in craft and related trades, followed by services and sales (24.9%). About 27% of the male population are into agriculture (Ghana Statistical Service, 2014). Fishing is the most dominant industry in the Municipality, followed by retail services then agriculture and forestry. Effutu

Municipality is characterized by many educational institutions. These include three campuses of UEW, Ghana Police Commander and Staff College, Community Nursing Training College, Vocational institution and four Senior high schools.

A third (33.8%) of the population of school going age are currently in primary school, 13.3% at the Junior High School (JHS) level, less than one-tenth (6.9%) in the Senior High School (SHS) and close to 28% are at the tertiary level (Ghana Statistical Service, 2014).

Effutu Municipality is divided into three circuits: The East, West and Central circuits. The number of basic schools, both public and private, in the East, West and Central circuits is 39, 33 and 23 respectively (Effutu Municipal Education Directorate, 2017).

Source: Ghana Statistical Service, 2014

Fig 2: Map of Effutu Municipality.

3.3 Population

A research population is a large well-defined collection of individuals having similar features (Castillo, 2009). Castillo differentiates between two types of population, the target population and accessible population. The target population is the total group of subjects to which a researcher would like to generalize the results of a study and accessible population is the group of subjects that is accessible to the researcher for a study from which the study sample can be drawn (Castillo, 2009).The target population for the study comprised all Junior high Schools teachers in the Effutu Municipality. There are 49 public and private JHS in the Municipality with 399 teachers. The accessible population comprised all JHS integrated science teachers in the Effutu Municipality. It consisted of 76 teachers from 49 public and private schools within the three circuits.

3.4 Sample and Sampling Techniques

A sample is defined as a group of relatively smaller number of people selected from a population for investigation purposes (Alvi, 2016). According to Neuman (2000), a sample is a smaller set of cases a researcher selects from the larger pool, and generalizes to the population.

The sample for this study comprised 76 junior high school integrated science teachers from 49 JHS both public and private schools in the Effutu Municipality in the Central Region of Ghana. Census sampling technique was used to obtain the sample. The justification for the use of census sample technique was that the researcher could cover all the respondents (accessible population) in the Municipality since the numbers of integrated science teachers in the research area are not large.

Table 2 is a breakdown of the municipality into educational circuits and the number of schools and JHS teachers in each circuit.

Table 2: Distribution of the Sample

Name Of Circuit	Junior High School			
	Number of Public School	**No of science teachers**	**Number of Private School**	**No of science teachers**
Circuit A	7	10	9	16
Circuit B	7	7	8	13
Circuit C	8	11	13	19
Total	**22**	**28**	**27**	**48**

Source: Effutu Municipal directorate, EMIS (April, 2019)

Purposive Stratified sampling technique was used to select a sub-sample of 9 teachers for the qualitative phase of the study which involved classroom observation and interviews. The sample was put into two strata, that is teachers with high curriculum knowledge as one stratum and the other made up of teachers with low curriculum knowledge. Each stratum was further stratified into male and female respondents and proportionate sampling was used to obtain five males and four females.

3.5 Research Instruments

In a research into Junior high schools integrated science teachers‟ curriculum knowledge and instructional practices, it was necessary to understand the characteristics of Junior High School science teachers and what shaped their curriculum knowledge, and approach of science instruction and assessment. Multiple data collection methods, involving both quantitative and qualitative approaches, were used to achieve this.

The instruments used to collect data for the study were questionnaire and classroom observation and interview schedules. The questionnaire was used to collect quantitative data on the junior high school integrated science teachers‟ curriculum knowledge, assessment practices and instructional practices while the observation and interview schedules were used to collect qualitative data on the teachers‟ instructional and assessment practices, the instruments were used in a collaborative way. The questionnaire used in the first phase of the data collection for the study provided primary data on the basis of which the classroom observation and interview were carried out at the second and third phase of the data collection respectively. The instruments are described in the following sections.

3.5.1 Questionnaire

Questionnaire is a set of questions or items that are to be answered by a respondent in a research (Ogah, 2013). Also questionnaires are documents that ask the same questions of all individuals in the sample and respondents record a written response to each questionnaire item (Borg, Gall & Gall, 1996). Questionnaires are the most widely used instruments for data collection and they are based on the objectives of the study. Advantages of using questionnaire include lower cost of sampling respondents over a wide area, less time is required to collect data and confidentiality is also assured. However, questionnaires cannot probe deeply into respondents‟ opinions and feelings. Also, once the questionnaire is distributed, it is not possible to modify the items, even though they may be unclear to some respondents (Borg, Gall & Gall, 1996).

The researcher considered the use of a questionnaire since the participants could read, write and understand. Although, there was a probability of having a low return rate, it enabled the researcher to collect large amount of data in a minimum time and at a lower cost.

A combination of closed and open ended questionnaire was employed in this study to give respondents the opportunity to reveal their motives about the responses they ticked. The questionnaire consisted of 56 items which were grouped under three parts. (Appendix A). The first part looked at science teachers profile, the second part looked at science teachers‟ curriculum knowledge and the third part looked at science teachers‟ assessment practices. The first part of the questionnaire consisted of seven multiple choice questions of which teachers were required to tick their appropriate choice. The questions were about teachers‟ name of circuit, area of teaching (public or private), gender, academic and professional qualifications, area of specialization, classes taught and years of teaching experience. The second part of the questionnaire which was in three sections (A, B, and C) consisted of 29 items distributed among the sections. Section A which consisted of 6 multiple choice items was on science teachers‟ knowledge about science curriculum materials. Section B which consisted of 8 items was on science teachers‟ general knowledge of the JHS science curriculum. Out of the 8 items, 6 were open - ended and 2 multiple choice items. Section C which consisted of 15 items was about science teachers‟ content knowledge of the integrated science curriculum. Out of the 15 items, 12 were open ended questions and 3 were close - ended questions.

The third part of the questionnaire consisted of four section (Section A, B, C and D). Section A consisted of 6 multiple choice items on science teachers‟ organisation of classroom assessment. All the six were multiple choice questions. Section B consisted of 6 items on the types of assessment science teachers‟ used in their classroom. Out of the 6 items, 4 were open – ended questions and two multiple choice questions. Section C consisted of 6 items on the type of feedback teachers give after marking pupils‟ task. Out of the 6 items, 4 were open – ended questions and 2 multiple choice questions. Section D consisted of 2 items on science teachers‟ use of assessment results. Out of the 2 items, one was open – ended question and the other multiple choice question.

3.5.2 Observation

A non-participant observation schedule was used to collect data on integrated science teachers‟ classroom practices. The observation schedule was an inquiry based observational schedule which was developed by Bybee (2006) (Appendix B) and adapted for this study. Bybee model involve five phase (Engagement, Exploration, Explanation, Elaboration and the Evaluation). The adaptation of the observation schedule was guided by the stages of lesson delivery outlined in the curriculum. The stages are introduction, activities and evaluation. The introduction stage was made up 6 indicators which sought to find out how teachers stated the purpose of the lesson, create curiosity, raise appropriate questions, elicits responses that uncover prior knowledge, identified and records student thinking and create the opportunity for pupils to question. The presentation stage was made up of 22 indicators which sought to determine how integrated science teachers practiced inquiry-based instruction while the evaluation stage was made up of 7 indicators which sought to find out how teachers evaluated their lessons and guided pupils to apply concepts.

3.5.2.1 Scoring of the Classroom Observation Schedule

The use of any activity on the checklist was identified by a tick against that behaviour. In this identification, all judgments were used liberally; for instance, a mere occurrence of an item was seen as being used. Frequency counts were taken for the number of times activity occurred in each lesson. The total frequency counts for each item in each lesson were then determined and converted to percentages.

3.5.3 Semi-Structured Interview Guide

Semi-structured Interview guide was used to collect qualitative data to validate the information provided on the questionnaire (Appendix C). A semi-structured interview is where the researcher designs a set of key questions to be raised before the interview takes place, but builds in considerable flexibility about how and when these issues are raised. The researcher allows a considerable amount of additional topics to be built on, in response to the dynamics of conversational exchange (Dampson & Mensah, 2014). Semi-structured interviews ensure flexibility of follow-up questions that may arise in the course of interviewing and create room for easy responses to these questions (Bryman, 2008).

The interview guide was made up of 16 items which sought further clarification on the information provided on the questionnaires. The 16 open-ended items on the interview allowed for further probing based on the responses given by the participants.

3.6 Validity

Validity of a research instrument is determined by how well it measures the concept(s) it is intended to measure (Awanta & Asiedu-Addo, 2008; Ruland, Bakken & Roislien, 2007). It indicates the degree to which an instrument measures the construct under investigation. Face and Content validities of the instruments were established.

3.6.1 Face Validity

The researcher gave the instruments to colleagues and other graduate students of the University of Education, Winneba and the supervisor to establish the face validity of the instruments. They were requested to carefully scrutinize and assess the for relevance. Issues such as length of questions, framing of questions, and ambiguity were considered. The feedback from the graduate students and the supervisor were factored into the final preparation of the instruments.

3.6.2 Content Validity

Content validity is a measure that gauges whether there is adequate coverage of all the research questions (Cooper & Schindler, 2008). It indicates whether the technique assesses or measures what it is supposed to measure (Ruland, Bakken & Roislien, 2007). In other words, it is a judgmental assessment on how the content of a scale represents the measures. An effort was made to ensure that the items of the instrument covered all the research questions posed in the study which were supposed to be answered from data obtained from the questionnaire, interview guide and observational guide. Also supervisors and some lecturers were served with copies of the questionnaires, interview guide and observation schedule to determine whether the items covered all the research questions. Suggestions such as the content and format of the instrument must be consistent with the definition of the variable and the sample of subject to be measured received from them were used to refine and sharpen the content of the instrument making instrument more relevant and valid for the purpose of the study.

3.7 Reliability

Reliability refers to the consistency and dependability of a test results. It is often defined as the degree to which a test is free from errors of measurement (Ebel & Frisbie, 2007). A test is reliable if similar result is repeatedly obtained that is, the extent to which results are consistent over time and if the results of a study can be reproduced under a similar methodology (Joppe, 2000).

The Cronbach alpha value for integrated Science Teacher" Curriculum Knowledge (ISTCK) questionnaire was 0.76. Experts argue that Cronbach alpha coefficient should be at least 0.70 to be indicative of high reliability (McMillan & Schumacher, 2010). Similarly, Patton (2002) argues that instrument with reliability coefficient of between 0.7 and 0.9 has excellent internal consistency and measures what it purports to measure. Based on these assertions, the instruments are judged to be of high reliability and therefore suitable for data collection for this study.

3.7.1 Quantitative

In order to ensure the reliability of the questionnaire, the questionnaire was pilot tested using twenty teachers in Ewutu Senya District of the Central Region of Ghana. This is because the District has similar features with the study area. The teachers responded to the items.

The reliability of the items on the instrument was verified by examining the Cronbach Alpha reliability coefficient of the instrument. The Statistical Package for Social Sciences (SPSS) software version 22 was used for the analysis of the items on the instrument. The overall Cronbach alpha value for integrated Science Teacher" Curriculum Knowledge (ISTCK) questionnaire was 0.76. The result shows that the items on the questionnaire had excellent internal consistency and therefore capable of measuring what they purported to measure. This statement is backed by Patton (2002) who stated that an item with reliability coefficient between 0.7 to 0.9 have excellent internal consistency and therefore capable of measuring what are purported to measure.

3.7.2 Qualitative

The data were used to establish the trustworthiness of the observation schedule. Two science teachers with strong science background were sampled and trained on how to use the observation schedule and to help determine its percentage inter- rater reliability. The observation schedule was discussed with the assistants.

This was followed up by classroom trails. Two science lessons were used to provide the assistants with a training session to enable them use the schedule during the data collection. They observed one lessons each of two science teachers who were not to participate in the second phase of the data collection. The results of the observations by the assistants and that of the researcher were compared and discussed to resolve any discrepancies. This was followed up by another set of observations by the assistants and the researcher for the former to further improve their skills on the administration of the instrument. The calculated percentages inter - rater reliability improved from the first trails to the second trails, that is, from 75 % to 80 %. These were found to be within the ranges reported in literature (Borg, Gall & Gall, 1996; Patton, 2002).

In addition, the researcher sought expert advice on the reliability of the semi-structured interview guide. The criteria used were: credibility, Dependability, Conformability, transferability, thus their consistency over time and conformability, thus, how well suited them are with the objectives of the study.

3. 8 Data Collection Procedure

The researcher obtained letter of introduction from the Department of Basic Education of the University of Education, Winneba (Appendix D) which was used to obtain permission from the Municipal Director of Education and Heads of the sampled Junior High Schools to carry out the study. The Director subsequently granted permission to the researcher in order to have access to the participants (Appendix E).

Data was collected in three phases. The first phase involved the administration of the questionnaires. The second phase involved observation while the third phase involved interviews. The arrangement in Table 3 guided the data collection phase of the study.

Table 3: Schedule of data collection Visit

Visit	Purpose
First visit	Distribution of letters and getting acquainted with Head teachers and JHS Integrated science teachers
Second visit	Taking teachers through the purpose of the exercise and Administration of questionnaires
Third Visit	Collection of questionnaires
Fourth visit	Observation the sampled teachers
Fourth Visit	Interview of the sampled integrated science teachers

Source: Effutu Municipal Directorate, EMIS (April, 2019)

The researcher undertook a familiarization visit to schools in the Municipality and distribute letters and also explain the purpose and benefit of the study to the teachers.

3.8.1 Quantitative Phase

The researcher went to the various schools and distributed the questionnaire to the teachers in Municipality. Since the questionnaires sought to measure teachers" curriculum knowledge and assessment practices the researcher encourage the teachers to complete the questionnaires and return them on the same day. This was to ensure that teachers did not get the opportunity to communicate among themselves or refer to other materials for information. It took ten days for the researcher to administer the questionnaires to all teachers in their Municipality.

3.8.2 Qualitative Phase

Two weeks after the collection of the questionnaire, the researcher visited the selected teachers to observe their Lesson. Two teachers were observed each day. The observation lasted for five days. The researcher and the assistant observed and ticked any inquiry-based instructional practices by the teacher in the process of lesson delivery. The following keys were used to score participant"s performance on the observation schedule: No Evidence = 0; Minimum Evidence = 1; Some Evidence = 2; Clear Evidence = 3; Clearer Evidence = 4 or more ticks.

In order to maintain confidentiality in this study, the researcher used symbols, T1, T2, T3, T4, etc, to represent each of the participants. The JHS science teachers were not given specific topics to teach for the researcher"s classroom observations. The topics taught by the teachers were from the teacher"s scheme of work for the term. Also, though some of the topics taught varied from teacher to teacher they were all contained in the scheme of work of all the teachers. Each participant"s lesson was observed once and each observation lasted for about 70 minutes equivalent to a double period stipulated on the school"s teaching time table. Notes were taken on issues observed but which were not part of the observation schedule. Some of the issues were number of pupils in the classroom, the topic for the lesson, teaching and learning materials used in the lesson, classroom routines and physical arrangement of the classroom.

The observation process was completed in five days. Each participant was interviewed immediately after the observation. The researcher further probed the participants for more information. Each interview lasted for about 40 minutes. It was one-on-one interview. The interviews, with the permission of the interviewees were audio-tape recorded and later transcribed by the researcher.

3.9 Data Analysis

According to Berg cited by Ako (2017) data analysis involves the breaking up of data into manageable themes, patterns, trends and relationships. The data collected for the study were analysed separately as quantitative and qualitative data.

3.9.1 Quantitative Data Analysis

The quantitative data was collected through the ISTCK. Descriptive statistics in the form of simple percentages, frequency, mean and standard deviation and inferential statistics (Pearson Product Moment Correlation) were used to analyze the quantitative data. Statistical Product for Service Solution (SPSS) software version 22 was used to analyse the quantitative data. Frequency and percentages counts were used to describe integrated science teachers‟ level of curriculum knowledge and classroom instructional and assessment practices. Data obtained from part I of the ISTCK instrument were organized into frequency counts and percentages and used to understand the background information of the participants.

That of part II was also organized into frequencies and converted into percentages and used to describe teachers‟ knowledge about the integrated science curriculum. This was used to answer research question one.

Pearson Product-Moment correlation was used to assess the strength and nature of relationship that exist between integrated science teachers‟ background factors and their knowledge of the integrated science curriculum. This was used to answer research question two.

Data from part III of the ISTCK questionnaire was also organized into frequency counts and percentages and used to describe teachers‟ classroom assessment practices.

3.10.2 Qualitative Data

The data collected through the observational schedule was used to validate the teachers‟ responses on the questionnaire and also to determine whether the instructional approaches of integrated science teachers were inquiry-based and child-centred. The data was analysed using frequency counts and percentages for easy discussion. The keys used for each activity were based on the total number of ticks on each indicator. Total frequency and percentage score for each indicator as well as total frequency and percentage for each teacher was determined and categorized in Table 4 and used to describe the level of the teacher‟s use of child-centred or teacher- centred instructional strategies.

Table 4: Percentage Range Used to Categorize Teachers' Level Instructional Approach

Evidence	Percentage range %	Level of instructional approach
No Evidence	0	Teacher-centred instructional approach
Minimum Evidence	1 – 25	
Some Evidence	25 – 50	
Clear Evidence	51 – 75	Child-centred instructional Approach
Clearer Evidence	76 - 100	

Source: Effutu Municipal directorate, EMIS (April, 2019)

Teachers who scored more than 50% on the schedule were categorized as advocates of leaner-centred instruction while those who scored less than 50% were categorized as advocates of teacher-centred instruction. The analysis of data from the observation was used to answer research question three.

The qualitative data were obtained from the open-ended items on the ISTCK questionnaire, interviews and lessons observed used to answer the research questions. The responses to the open ended items were coded. The responses were then organized into the themes and analysed.

The data collected with the observation schedule was used to validate that of the questionnaire. In addition to this, they were used to find out whether the teaching strategies or approaches the JHS teachers used in the science lessons were aspects of inquiry-based science instruction.

Interview data collected from teachers were used to validate the responses obtained from the questionnaires. The interview guide focused on teachers" knowledge of the integrated science curriculum and classroom instructional and assessment practices.

All interviews were audio-taped after the researcher sought permission from the participants and later transcribed by listening to the tapes severally. The researcher then transcribed the recording word-for-word. The researcher later read through the texts to identify emerging themes. Verbatim quotations were used to support the discussions.

3.10 Ethical Consideration

Ethical issues that were considered in this study were the permission to collect data, confidentiality, anonymity and the protection of participants (Berg, 2001; Patton, 2002).

Voluntary Participation: participants were not forced to participate but voluntarily participated in the data collection process. They were also told that, at any point in time they can opt out of the process.

Informed Consent: the participants were duly told of the relevance of the project and how they can participate.

Confidentiality and Anonymity

The researcher ensured that no one could identify the participants from the information provided. This was done by not indicating names, addresses and particular names of individual schools of participants. All these were not indicated on the formal report presented. Participants were given coded names instead of their real names.

CHAPTER FOUR

RESULTS

4.0 Overview

This chapter presents the findings on JHS integrated Science Teachers‟ Curriculum Knowledge, classroom instructional and assessment practices. The quantitative data was used to answer research questions 1, 2 and 4 while the qualitative data was used to answer research question 3. The findings were presented in seven sections:

1. Characteristics of the study sample and sub-sample;
2. Teachers‟ knowledge of the integrated science curriculum;
3. Integrated science teachers‟ knowledge about the organization of science curriculum;
4. Integrated science teachers content knowledge of the integrated science curriculum;
5. Relationship between Integrated science teachers‟ background factors and their content knowledge of the integrated science curriculum;
6. Integrated science teachers‟ classroom instructional practices
7. Integrated science teachers‟ classroom assessment practices.

4.1 Demographic Information on the Characteristics of the Study Sample

Demographic information of each participant was collected. The results of the analysis are presented in Table 5.

Table 5: Summary of Demographic Characteristics of Public and Private Integrated Science Teachers in Effutu Municipality (n = 75)

Demographic factors	Category	Frequency	Percentage (%)
Circuit	East	20	26.7
	Central	29	38.7
	West	26	34.6
	Total	**75**	**100.0**
School of teaching	Public	35	46.7
	Private	40	53.3
	Total	**75**	**100.0**
Sex	Male	54	72.0
	Female	21	28.0
	Total	**75**	**100.0**
Academic qualification	G.C.E. Ordinary Level	2	2.7
	G.C.E. Advanced Level		00.0
	SSSCE/WASCE	19	25.3
	Diploma(Basic Education)	5	6.7
	B. Ed Basic Education	30	40.0
	HND	6	8.0
	B. Ed Science	2	2.7
	Others	11	14.6
	TOTAL	**75**	**100.0**
Professional qualification	Cert 'A' 4 Year	7	9.3
	Cert 'A' Post Sec	4	5.4
	Diploma (Basic Education)	6	8.0
	Diploma in Education	27	36.0
	B. Ed (Basic Education)	31	41.3
	TOTAL	**75**	**100.0**
Number of years of teaching	0 - 3 years	19	25.3
	4 - 6 years	17	22.7
	7 - 10 years	23	30.7
	More than 10 years	16	21.3
	Total	**75**	**100.0**
Junior high classes taught	JHS 1	4	5.3
	JHS 2	8	10.7
	JHS 3	9	12.0
	JHS 1and 2	13	17.0
	JHS 2 ad 3	8	10.7
	JHS 1 and 3	5	6.7
	JHS 1,2 and 3	28	37.3
	Total	**75**	**100.0**

Source: Effutu Municipal directorate, EMIS (April, 2019)

A questionnaire was administered to 76 integrated science teachers both in Public and Private in the Effutu Municipality in the Central Region of Ghana. Out of this number, 75 participants completed and submitted their questionnaire making a return rate of 98.6%. Out of the 75 integrated science teachers in the Municipality, 26.7% (20) were from East Circuit, 38.7% were from Central Circuit and 34.6% were from West circuit. This showed that Central Circuit has the highest number of integrated science teacher followed by West circuit. Out of the 75 science teachers, 46.7% were from Public schools and 53.3 were from Private schools. This attested to the fact that a little of half of the integrated science teachers in the Municipality are from private schools. Also out of 75 teachers, 72% (54) were males and 28% (21) were females. This shows that majority of integrated science teachers in the Municipality at the time of this study were males. More male teachers are usually posted to the JHS level and therefore males represent a significant number of the teaching work force at the JHS level in the Effutu Municipality.

Also, majority of teachers (40%, 30) in the Municipality had B.Ed (Basic Education) as their highest academic qualification. This was followed by those with SSSCE/WASSCE (25.3%, 19), then followed by others qualifications (14.6%, 11). Further details are provided in the table.

The highest number of professionally trained teachers (41.1%, 31) were those with B.Ed. (Basic Education). This was followed by Diploma in Basic Education (36.0%, 27) whiles the least number of professionally trained teachers (9.3%, 7) had Cert „A" 4 Year. This shows that all integrated science teachers who participated in the study had some level of professional training as teachers.

The results showed that integrated science teachers had varied years of teaching experience. The teachers" years of teaching experience ranged from zero to above ten years. The respondents who had taught for 6 years or below were 36(48.0%). Also those who taught between 7 and 10 years were 23 (30.7%) while those who taught for more than 10 years were 16 (21.3%). This indicates that a little of half of the teachers (52%) had taught for more than six years. The results further indicate that 37.3% (28) of the teachers taught both JHS 1, 2 and 3. Also, teachers who only taught one class were 21 (28.0%).

Again, 34.4% (26) of the teachers taught two classes. Whilst (4.3%, 10) teachers taught all three classes. This shows that majority of teachers taught more than one class while few of them taught one class.

4.2 Characteristics of Subsample

The subsample was made up of 9 JHS science teachers (5 males and 4 females) with teachers" with high orientation and four teachers" with low orientation about science curriculum knowledge and classroom instructional practices. The information obtained from the questionnaire was used to stratify the respondents into two strata, namely, teachers with high and low orientation of science curriculum knowledge respectively. A criterion of 60% of the total score of a respondent on the questionnaire was used as an indication of a science teacher"s likelihood to use appropriate instructional and assessment practices in their classroom while a score of below 60 % was taken as an indication of the teacher"s unlikelihood to use appropriate instructional and assessment practices in their classroom. A similar criterion was used by Turkmen (2002) in an attitudinal study to select a subsample for classroom observations. Based on this criterion, five teachers (three males and two female) were categorized as teachers with high and while four teachers (2 males and two female) were categorized as teachers with low orientation towards appropriate used of science instructional and assessment strategies.

The subsample was used for the second phase of the study. Apart from three JHS science teachers who obtained B.Ed (Basic Education) and two with Diploma in Basic Education from public school, all the other teachers obtained Senior Secondary School Certificates as their highest academic qualifications were from private schools. The number of years of teaching experience of the participant ranged between one and seven years and all of them were teaching in all the three JHS classes.

4.3 Research question 1: What knowledge do Effutu Municipal Junior High School Integrated Science Teachers' have about Integrated Science Curriculum?

The research question sought to examine the level of JHS integrated science teachers" knowledge of the integrated science curriculum. Results from Part II sections A, B and C of the Integrated Science Teachers Curriculum Knowledge (ISTCK) questionnaire were used to answer the research question. Section A of the questionnaire sought to examine integrated science teachers knowledge of the integrated science curriculum materials. Section B focused on integrated science teachers" knowledge about the organization of the syllabus while section C investigated find out integrated science teachers" content knowledge of the integrated science curriculum. The responses of teachers were organized into frequency counts and converted into percentages and presented into tables.

4.3.1 Section A: Teachers' Knowledge of the Integrated Science Curriculum Materials

The analysis of the results of participant"s responses to items of section A of the questionnaire are presented in Table 6.

Table 6: Integrated science teachers' knowledge of the Integrated science curriculum materials

Curriculum materials	Responses	Frequency	Percentage (%)
Presence of curriculum material	Yes	75	100
in your school	No		
Kind of curriculum materials teachers use in schools			
Presence of syllabus	Yes	52	69.3
	No	23	30.7
Presence of Teachers" Guide	Yes	44	58.7
	No	31	41.3
Presence of Pupils" textbook	Yes	39	52.0
	No	36	48.0
Presence of Charts/Picture	Yes	22	29.3
	No	53	70.7
Presence of Other materials	Yes	18	24.0
	No	57	76.0
No teaching –learning materials	Yes	2	2.7
	No	73	97.3
Use of curriculum materials in	Yes	69	92.0
lesson preparation and delivery	No	6	8.0
How often materials are used for	Sometimes	5	6.7
lesson preparation and	Often	19	25.3
presentation	More often	3	4.0
	Always	42	56.0
	No response	6	8.0
Topics in teachers" guide and	Yes	61	81.3
textbook correspond to those in	No	4	5.3
syllabus	Not sure	10	13.4
Teaching and learning activities	Yes	40	53.3
in teachers" guide and textbooks	No	14	18.7
correspond to that of syllabus	not sure	21	28.0

Source: Effutu Municipal directorate, EMIS (April, 2019)

The data presented in Table 6 indicates that 100% (75) of the teachers had at least one curriculum material in their school. Sixty-nine percent of the teachers had the syllabus in their schools while 58.7%, (44) teachers had the teachers" guide in their schools. In addition, 52% (39) of the teachers indicated that there were pupils" textbooks in their schools. Also, 70.7%, (53) teachers said they did not have charts and pictures in their schools for teaching integrated science. Furthermore, as many as 76.0%, (57) of the teachers said they did not have other supplementary materials for teaching integrated science. This means that majority of teachers had the main curriculum materials such as syllabus, textbooks and teachers" guide in their schools. However, greater number of them did not have other supplementary teaching and learning materials.

Although majority of the respondents 92.0%, (69) indicated that they used curriculum materials in their lesson preparation and delivery, only about half of them (56.0%, 42) always used curriculum materials in their lesson preparation and presentation. This meant that some of the teachers did not use curriculum materials such as syllabus, teachers" guide and textbooks in their lesson preparation and delivery. Also, 81.3% (61) agreed that the content of the teacher"s guide and textbooks corresponded to those in the syllabus. Little over half of the teachers (53.3%, 40) indicated that the teaching and learning activities in the teacher"s guide and textbooks corresponded to that of the syllabus

Interview was used to probe further how the presence or absence of curriculum materials impacted on their lesson preparation and presentation. The responses indicate that the entire teachers lacked at least one curriculum material in their schools which usually affected their lesson preparation and lesson delivery in the integrated science classroom. This is confirmed by excerpts from responses of some of the interviewees:

> *"I have some of the materials but not all of them. I have only Form 1 syllabus, even though the one I had is a soft copy given to me by a friend. With the rest of the syllabus I normally go to my colleagues for theirs". I normally contact colleagues teachers from different schools who were having some of the materials to aid me in my preparation of lesson* (T1)

One other interviewee asserted that:

> *I have a syllabus in the school but it's the 2008 version, I don't have the current syllabus (2012), I only depend on the old syllabus. The old syllabus was given to me when I was posted to the school. I know there some of the teachers from different school had the syllabus. Because I don't have the current syllabus, it makes teaching difficult. (T2)*

Another interviewee said:

> *I have the syllabus but it is soft copy, it was given to me by my colleagues (T3)*

> *The curriculum materials l have is only the textbook, and teachers guide, l use the teacher's guide for lesson preparation. The textbooks in the school are not enough and the content is based on the old syllabus (T4)*

> *Most of the curriculum materials I used are improvised, I make photocopy of the textbook from colleagues from different schools. (T5)*

> *I have syllabus and teacher's guide without other curriculum materials to aid lesson preparation (T6)*

> *We have all the curriculum materials in the school only that they are not enough, especially pupils textbooks are less than the number of pupils in a class. (T7, T8)*

> *I have hard copy of teachers guide only, but the rest of the materials (syllabus) are softcopy on my laptop. (T9)*

The problem encountered by some teachers‟ inability to have some of the curriculum material might affect the teachers‟ lesson preparation.

About 92% (69) of the teachers responded that, they used the curriculum materials in their lesson preparation and delivering. Fifty six percent of teachers often used the materials in lesson preparation ad presentation.

> *Due to my inability to have all the curriculum materials it very difficult to compare whether the teaching and learning activities in the teacher's guide ad textbook correspond to that of syllabus. (T5)*

The above responses indicated that most of the teachers lacked one or two of the curriculum materials in their schools. Hence this will adversely affect teachers‟ lesson preparation.

4.3.2 Section B: Integrated Science Teachers' Knowledge about the Basic Science Curriculum

The results of analysis of the participant‟s responses to the items of section B of the questionnaire are presented in Table 7.

Table 7: Integrated Science Teachers' Knowledge on the organization of the syllabus

Component	Correct Responses	Frequency	Percentage (%)
1. The rational for teaching science		49	67.1
2. Number of themes of science syllabus	5	72	98.6
3. Identification of the themes			
Diversity of matter		62	84.9
Cycles		52	71.2
Systems		71	97.2
Energy		70	95.8
Interactions of matter		69	94.5
1. Number periods for teaching integrated science	6	73	100
2. Number of periods allocated for the teaching of theory	2	73	100
3. Number of periods allocated for the teaching of practical	4	73	100
4. Weight of profile dimension of Knowledge and Understanding	20%	60	82.2
5. Weight of profile dimension of Application of Knowledge	40%	71	97.3
6. Weight of profile dimension of experimental and Process Skills	40%	69	94.5
7. How the profile dimensions influence teaching of integrated science	Develop critical thinking skills	22	30.1
	To know pupils ability to express themselves	13	17.8
		10	13.7
	it is in the syllabus		
		17	23.3
	To help pupils to know level of understanding	11	15.1
	To satisfy each profile dimension		
8. Instructional approach recommended in integrated science teaching	Pupils centred	39	53.4
	Teacher centred	27	36.9
	Others	7	9.7
9. Form of assessment recommended in integrated science syllabus	Summative	12	16.4
	Formative	14	19.2
	SBA	47	64.4

*two participant did not provide a response.

The data presented in Table 7 shows that 67.1% (49) of the teachers were able to give the rational for teaching. Also, 98.6% of the teachers were able to give the correct number of themes of the integrated science curriculum. Also, majority of teachers were able to name the themes of the curriculum. For example, between 97.2% and 71.2% of the teachers correctly named all the themes of the curriculum. This means that majority of teachers have knowledge of the number of themes in the natural science syllabus.

Also, 100% (73) of the teachers successfully mentioned the number of periods allocated for teaching integrated science and also all the teacher were able to indicate the correct number of periods allocated to the teaching of theory and practical work respectively. This means that all the teachers will teach without recourse to the allocation of periods for theory and practical work. Four periods out of the total of six periods per week should be allocated to practical work while the remaining periods are allocated for teaching theory.

Furthermore, with regard to the weights of the profile dimension of knowledge and comprehension, more than half of the participants (82.2%, 60) correctly gave the weight for the dimension. Also, 97.3% (71) of the teachers were able to provide the correct weight for application of knowledge while 94.5% (69) of the teachers gave correct weight for the profile dimension of experimental and process skills. This means that on average, the teachers had high knowledge on the weights for profile dimensions specified for teaching, learning and assessment. The implication is that, majority of the teachers are likely to emphasize the weight of the profile dimensions in their teaching and assessment practices. The integrated science syllabus dictates that, the weight of the profile dimension of knowledge and understanding should be

20%, application of knowledge, 40% and experimental and process skills 40%. When asked how the profile dimensions influenced their teaching and assessment of integrated science in the classroom, 30.1% (22) of the teachers responded that they used them to develop critical thinking skills among the pupils. Again, 17.8% (13) of the teachers said they used the profile dimensions to know ability and express themselves, about 14% (10) of the teachers also said they used the profile dimension because it in the syllabus while 23.3% (17) of the teachers indicated that they helped them to know pupils" level of understanding of the content among others and 15.1% (11) said they used to satisfy each profile dimension. The results from teachers showed that most of them lacked knowledge on the important of the profile dimensions. However, the profile dimensions give a direction as to the relative emphasis that the teacher place on the teaching, learning and testing of the topics taught. Greater emphasis (40%) has been placed on "application of knowledge and experimental and process skills" to give pupils the necessary scientific process skills to enable them build their store of scientific concepts and principles. Also, 20% emphasis has been placed on knowledge and understanding.

About 53.4% (39) of the teachers indicated that the instructional approach recommended for teaching integrated science is pupil-centred approach while 36.9% (27) of the teachers said the recommended instructional approach is teacher-centred. However, about 9.7% (7) of teachers gave other responses such as experiments, investigation, demonstration, group work, etc as the recommended instructional approach for integrated science. This means that half of the teachers (53.4%) know the recommended instructional approach recommended for teaching integrated science which is child-centred.

Finally, over half (64.4%, 47) of the participants indicated that School Based Assessment (SBA) as the recommended assessment approach followed by formative assessment (19.2%, 14) and summative (12%, 12). This means that a good number of integrated science teachers exhibited fair knowledge of the assessment practices recommended in the curriculum. This means that they are likely to implement the SBA effectively as outlined in the syllabus.

The integrated science curriculum recommends the use of both formative and summative assessment procedures based on the profile dimensions. However, the SBA forms a fundamental part of assessment in schools and it highlights more on practical aspect of assessment which is expected to be administered over the term. Despite the fact that about 64% of the respondents had good knowledge of the SBA some of their responses from the interview indicated that, most of the teachers see the SBA as a form of a test instead of a series of assessment strategies.

One interviewee asserted that:

> *I normally organize SBA every week, I write the test item on the chalkboard for the pupils to answer. I do give them test every day, The SBA help me to know the performance level of my pupils (T3)*

> *I always assess the pupils every four week to find out how learning has taken place and pupils understand. SBA is a form of assessment which helps the science teacher to know the progress of his pupils. (T4)*

Another interviewee said that:

> *I do assess my pupils to know their progress. I normally give them project work, exercises etc. (T6)*

This shows that some of the teachers have fair knowledge of the SBA and other assessment methods stated in the integrated science curriculum.

4.3.3 Section C: Integrated Science Teachers' Content Knowledge of the Integrated Science Curriculum

This section sought to find out integrated science teachers" content knowledge of the integrated science curriculum. Teachers were asked to group the topics for the various classes under the five themes. The results of the exercise are presented in Table 8 below:

Table 8: Integrated Science Teachers' Grouping of JHS One Topics into the themes of the Integrated science syllabus. (n= 75)

Themes	Topics	Correct response	Percentage (%)
Introduction to science	Introduction to integrated science	61	81.3
	Measurement*	55	73.3
Diversity of matter	Matter	70	93.3
	Nature of soil	57	76.0
	Hazard*	62	82.7
Cycles	Life cycle of flowering plant	54	72.0
	Vegetable crop production*	69	92.0
Systems	Farming system	68	90.7
	Respiratory system of humans*	56	74.7
Energy	Sources of energy	51	68.0
	Conversion and conservation of energy	59	78.7
	Light Energy	66	88.0
	Basic electronic*	68	90.7
Interactions of matter	Ecosystems	59	78.7
	Air Pollution	65	86.7
	Physical and chemical changes*	57	76.0

(* indicates the last topic under a theme)

Table 8: indicates that 73.3% and 81.3% of the teachers‟ were able to group introduction to integrated science and measurement correctly under theme introduction to science respectively. Also, 93.3%, 76% and 82.7% of the teachers were able to respectively group, Matter, nature of soil and hazard correctly under diversity of matter respectively. For cycles, 72.0% of the teachers were able to put life cycle of flowering correctly and 92.0% (69) of the teachers were able to put vegetable crop production under correct themes (System) respectively.

Again, 74.7% (56) and 90.7% (68) of the teachers were able to put farming system and respiratory system of humans correctly under theme System respectively.

Also, under the theme Energy between 65.3% to 90.7% of the teachers were able to group the topics under energy correctly.

For interaction of matter, 78.7%, 86.7% and 78% of the teachers were able to respectively group Ecosystem, Air Pollution and physical and chemical changes correctly under it.

Table 9: JHS Science Teachers' groupings of JHS 2 topics under the themes. (n = 75)

Themes	Topics	Freq. of respondent	Percentage %
Diversity of matter	Elements, Compounds and Mixtures	53	70.7
	Metals and Non Metals	48	64.0
	Chemical Compounds	61	81.3
	Mixtures	49	65.3
	Water*	58	77.3
Cycles	Carbon Cycle	52	69.3
	Weather Season and Climate*	49	65.3
Systems	Reproduction in Humans	43	57.3
	Heredity	57	76.0
	Diffusion and Osmosis	54	72.0
	Circulatory System in Humans*	60	80.0
Energy	Photosynthesis	53	70.7
	Food and Nutrition	55	73.3
	Electrical Energy	60	80.0
	Basic Electronics*	49	65.3
Interaction of matter	Infectious Diseases of human and plant	57	76.0
	Pests and Parasites	40	53.3
	Force and Pressure	51	68.0
	Machines*	59	78.7

(* indicates the last topic under a theme)

Table 9 indicates that 70.7%, 64%, 81.3%, 65.3% and 77.3% of the teachers were able to group element, compounds and mixtures, metals and Non-Metals, chemical compound, Mixture and water correctly under the theme Diversity of matter.

Moreover, 69.3% (52) and 65.3% (49) of the teachers grouped carbon cycle and weather, season and climate under the theme Cycles correctly. Also, 57.3%, 76%, 72% and 80% of the teachers were able to respectively group reproduction in humans, heredity and Diffusion and Osmosis and circulation System in humans whiles 72.0 % (54) and 80.0% (60) of the teachers were able to group diffusion and Osmosis ad circulatory system in human correctly. Also, 70.7%, 73.3%, 80% and 65.3% of the teachers were able to respectively group each Photosynthesis, food and nutrition, Electrical energy and basic electronics correctly. For interaction of matter, 76%, 53.3%, 68.9 - 78.7% of the teachers grouped infectious diseases of human, pests and parasite force and pressure and machine correctly under theme respectively. This means that majority of the teachers had adequate knowledge on the organization of some topics under the various themes in the syllabus. However, few where unable to group the topic correctly.

Table 10: JHS Science Teachers' groupings of JHS 3 topics in Science Curriculum. (n = **75)**

Themes	Topics	Frequency of respondent	Percentage
Diversity of matter	Acids and Bases	51	68.0
	Soil, Water and Conservation*	48	64.0
Cycles	Life Cycle of the Mosquito	72	96.0
Systems	The Solar System	70	93.3
	Dentition in Humans	69	92.0
	Digestion in Humans*	44	58.7
Energy	Heat Energy	51	68.0
	Basic Electronics*	55	73.3
Interaction of matter	Magnetism	47	62.7
	Science related industries*	39	52.0

(The symbol * indicates the last topic under a theme)

Table 10 indicates that, 68.0% (51) and 64.0% (48) of the teachers were able to group Acid ad bases and Soil, Water and Conservation correctly under Diversity of Matter. For Cycles, 96.0% (72) of the teachers grouped life cycle of the mosquito correctly.

Again for systems, about 93.3%, 92%, 58.7% and 93.3% of the teachers respectively grouped solar energy, dentition in humans and digestion in humans correctly. For energy, about 68.0% (51) of the teachers grouped heat energy correctly while 73.3% (55) of the teachers grouped basic electronic correctly. Also under interaction of matter about 62.7% and 52.2% of the teachers respectively grouped magnetism and Science related industries correctly.

4.3.4: JHS Science topics teachers' teach with difficulties or those they teach with Ease.

This section sought to find out topics teachers teach with ease and those they teach with difficulty. Teachers were asked to write down those topics they consider difficult or easy to teach. Their responses are presented in Table 11, 12 and 13.

Table 11: JHS 1 topics science teachers teach with difficulty or with ease. (n=75)

Themes	Topics	% Freq of teachers who teach topics with ease	%Freq of teacher who teach topics with difficulty
Introduction to science	Introduction to Integrated Science	100(75)	
	Measurement		
Diversity of matter	Matter	100(75)	
	Nature of Soil	100(75)	
	Hazards*	97.3(73)	2.7(2)
Cycles	Life Cycle of Flowering Plants	100(75)	
	Vegetable Crop Production*	93.3(70)	6.7(5)
Systems	Farming Systems	89.3(67)	10.7(8)
	Respiratory System of Humans*	92.0 (69)	
Energy	Sources of Energy	80.0(60)	20.0(15)
	Conversion and conservation of	73.3(55)	26.7(20)
	Energy	62.7(47)	37.3(28)
	Light Energy	89.3(67)	10.7(8)
	Basic Electronics*	78.7(59)	21.3(16)
Interaction of Matter	Ecosystems	73.3(55)	26.7(20)
	Air pollution	86.7(65)	13.3(10)
	Physical and Chemical changes*	60.0(45)	40.0(30)

(The symbol * indicates the last topic under a theme)

Table 11 indicates that all the teachers (100%) admitted that they teach all the topics under introduction to science, Diversity of matter except hazards under, farming system air pollution and source and forms of energy with ease. Also, 89.4% of the teachers indicated they teach respiratory system with ease while 10.6% indicated they teach that topic with difficulty. Also, 76.6% of the teachers indicated they teach conversion of energy with ease while 23.4% of the teachers indicated they teach that topic with difficulty. Also 21.3% indicated that they teach basic electronics with difficulty. Also 68.1% of the teachers indicated that they teach light energy with ease while 31.9% of the teachers indicated they teach the topic with difficulty. Less than half (40.4%) of the teachers indicated they teach ecosystem with ease while 59.6% of the teachers indicated they teach the topic with difficulty. Also 29.8% of the teachers indicated they teach physical and chemical changes with ease while 63.8% of the teachers indicated they teach that topic with difficulty.

The 12 indicate that most teachers had difficulties teaching some topics under some themes whiles similar numbers taught topics under some themes with ease.

Over 80% of the teachers indicated that they could teach all the topics under system with easy. In fact all the teachers indicated that they could teach heredity and diffusion and Osmosis with easy.

The teachers indicated their difficulties in teaching topics under interaction of matter. This is because only between 24% and 38.7% of the teachers could teach those topics with easy. There was not much deference between the teachers who found the topics under diversity of matter easy or difficult to teach except water found all the teachers as easy to teach. Majority of the teacher (80%) found it difficult to teach Basic electronics under energy whiles 56% found food and nutrition easy to teach

Table 12: JHS 2 topics science teachers teach with difficulty and with ease.

Themes	Topics	**Freq. and % of teachers who teach topics with ease**	**Freq. and % of teachers who teach topics with difficulty**
Diversity of matter	Elements, Compounds and Mixtures	50.7 (38)	49.3 (37)
	Metals and Non Metals	58.7 (44)	41.3 (31)
	Chemical Compounds	52.0(39)	48.0(36)
	Mixtures	53.3(40)	46.7(35)
	Water*	100(75)	
Cycles	Carbon Cycle	44.0(33)	56.0(42)
	Weather, Season and Climate*	65.3(49)	34.7(26)
Systems	Reproduction in Humans	88.0(66)	12.0(9)
	Heredity	100(75)	
	Diffusion and Osmosis	100(74)	1.3(1)
	Circulatory System in Humans*	85.3(64)	14.7(11)
Energy	Photosynthesis	89.3(67)	10.7(8)
	Food and Nutrition	56.0(42)	44.0(33)
	Electrical Energy	70.7(53)	29.3(22)
	Basic Electronics*	20(15)	80.0(60)
Interaction of matter	Infectious Diseases of humans	38.7(29)	61.3(46)
	Pests and Parasites	25.3(19)	74.7(56)
	Force and Pressure	29.3(22)	70.7(53)
	Machines*	24.0(18)	76.0(57)

(The symbol * indicates the last topic under a theme)

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Table 13: JHS 3 topics science teachers teach with difficulty and with ease.

Themes	Topics	%Freq of teachers who teach topics with ease	%Freq of teachers who teach topics with difficulty
Diversity of matter	Acids and Bases	48.0(36)	52.0(39)
	Soil and Water Conservation*	92.0(69)	8.0(6)
Cycles	Life Cycle of the Mosquito	100(75)	
Systems	The Solar System	60.0(45)	40.0(30)
	Dentition in Humans	62.7(47)	37.3(28)
	Digestion in Animals*	66.7(50)	33.3(25)
Energy	Heat Energy	64.0(48)	36.0(27)
	Basic Electronics*	48.0(36)	52.0(39)
Interaction of matter	Magnetism	74.7(56)	25.3(19)
	Science related industries*	92.0(69)	8.0(6)

(The symbol * indicates the last topic under a theme)

Table 13 indicates that less than half (48.0%) of the teachers could teach Acids and bases with ease while 92.0% of the teachers found soil and water conservation easy to teach. Again, 100% of the teachers teach life cycle of mosquito with ease. More than half of the teachers teach topics under the System with ease. Also 64.0% and 48.0% of the teachers teach the topics (Heat Energy, Basic Electronics) with ease. More than half (74.7% and 92.0%) of the teachers teach Magnetism and Science related industries with ease. The teachers" acceptance of teaching some topics with difficulty indicates that the teachers have inadequate science subject matter knowledge to teach science topics effectively and this could have negative effect on the pupils" performance in science.

4.3.5 JHS Science Teachers' reasons for teaching some topics with ease and others with difficulty.

The JHS Science teachers" reasons for teaching some topics with ease and others with difficulty were arranged and grouped under five categories. Frequency counts were made for each category and the results obtained were converted to percentages. The teacher"s reasons are provided in Tables 14 and 15.

Table 14. JHS Science Teachers' reasons for teaching some JHS science topics with ease. (n = 75)

Categories of teachers reasons	Frequency	Percentage
The topic content not technical	15	15.8
Have adequate knowledge on the topics	19	20.0
Understand the concept of the topics well	8	8.4
Topics treated well in the textbooks	29	30.5
Topics do not involve calculations and formulas	24	25.3

Note: some teachers stated more than one reason.

Table 14 indicates that 15.8% (15) of the teachers stated that the content of some of those topics are not too technical, 20.0% (19) of the teachers stated that they have adequate knowledge in the topics while about 8.4% (8) of the teachers stated that they understand the concepts of the topics well and about 30.5% (29) of the teachers stated that the topics were well treated in the textbooks. But about 25.3% (24) of the teachers stated that the topics do not involve difficult calculation and formulas.

Interview was used to probe further on reason teachers teach science with ease.

The following are excerpts:

> *Most of the topics do not involve calculation, due to that it makes it teaching very easily. (T3)*
>
> *I regularly attend workshop on how to teach difficult topics in science so I don't challenge in teaching any of the integrated science topics. (T9)*
>
> *Most of the topics are treated well in the textbook, this makes it easier for me to teach with confident. (T5)*

Table 15. JHS Science Teachers' reasons for difficulty in teaching some JHS topics. (n = 75)

Categories of teachers reasons	Frequency	Percentage (%)
The topic content technical	**21**	**25.0**
Have inadequate knowledge on the topics	**17**	**20.2**
Do not understand the concept of the topics well	**19**	**22.6**
Topics not treated well in the textbooks	**11**	**13.1**
The topics involve calculations and formulas	**16**	**19.1**

Note: some teachers stated more than one reason.

Table 15 indicates that 25.0% (25) of the teachers stated the content of some of those topics were too technical while 20.2% (17) of the teachers stated they had inadequate knowledge on those topics. Again 22.6% (19) of the teachers stated they did not understand the concepts of the topics well. About 13.1% (11) of the teachers stated that the topics were not treated well in the textbooks and 19.1% (16) of the teachers stated that the topics involved difficult calculation and formulas.

> *Most of the topics in the syllabus are difficult to teach, some are too technical, and others too is difficult to teach without TLMs. (T1)*

> *I don't have enough knowledge on some the topics in the syllabus, most of the topics involves calculations, and am not all that good in mathematics so it makes feel uncomfortable teaching topics that involve calculations. Sometimes I have to seek help from my colleagues. (T6)*

4.4 Research Question 2: What relationship exists between Integrated Science Teachers' Background Factors and their Content Knowledge of the Integrated Science Curriculum?

This research question sought to find out the relationship that existed between integrated science teachers‟ background factors (professional, gender, academic qualification and years of teaching experience) and their content knowledge of the integrated science curriculum. A Pearson Correlation analysis was run between integrated science teachers‟ background factors and their content knowledge of the integrated science curriculum. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity.

The correlation result being significant at $p < 0.5$ means that the probability of obtaining the correlation by chance is less than five out of 100 (5%).

Table 16: Pearson Correlation: Relationship between Integrated science teachers' background factors and their content knowledge of the curriculum

Content knowledge	N	Gender	Academic qualification	Professional qualification	Number of years of teaching experience
CK 1	56	0.50	0.131	0.022	0.870
CK 2	52	0.182	0.453	0.001	0.336
CK 3	46	0.131	0.015	0.012	0.013

*Correlation is significant at 0.05 level (2-tailed). CK 1 = Content knowledge of JHS 1 curriculum, CK 2 = Content knowledge of JHS 2 curriculum, CK3 = Content knowledge of JHS 3 curriculum.

To further confirm the results of the combined indices of teachers" background, and their integrated science content knowledge, multiple correlation analysis of the combined variables with teachers" content knowledge using SPSS was carried out.

Table 16 shows the result of correlation analysis displaying the observed probability (sig.) value of the combined effects of the indices of teachers" background and their content knowledge. The probability value associated with the correlation for JHS teachers" content knowledge and their gender is 0.271 which is greater than 0.05 implying that there is no statistically significant relationship between JHS teachers" gender and their content knowledge, and the probability values associated with the F - statistics for teachers" content knowledge and their academic qualification is greater than 0.05 which means that there is no statistically significant relationship between academic qualification and content knowledge. On the other hand, the correlation between JHS teachers" professional qualification and content knowledge is lesser than

0.05 which means there is statistically significant relationship between the content knowledge of teachers and their professional qualification.

4.5 Research Question 3: What instructional practices do Effutu Municipal Junior High School Integrated Science Teachers' use in their classrooms?

The research question sought to find out integrating science teachers" classroom instructional practices. An inquiry based observation checklist was used to collect data to answer the research question. Classroom observation was necessary in this study because there was the need to investigate JHS integrated science teachers" understanding of classroom instructional practices of integrated science teaching. A total of nine JHS integrated science teachers were involved in the classroom observation. An inquiry-based Observational checklist developed by Bybee which was adapted by Ako (2017) was used to observe each of the nine JHS integrated science teachers. A matrix of instructional practices used by JHS integrated science teachers in the classroom were analysed and the results presented in Tables 17, 18 and 19.

4.5.1 Instructional practices used by JHS Integrated Science Teachers in the classroom at the introduction stage

This section sought to finds out integrated science teachers" instructional practices used at the introduction stage of their science lesson in the classroom. The results of the observation schedule presented in Table 17

Table 17: Matrix of Classroom instructional practices used by JHS Integrated Science Teachers in the classroom at the introduction stage

S/N	Introduction stage	T1	T2	T3	T4	T5	T6	T7	T8	T9	Total
1	States the purpose and expectations for learning	3	4	1	3	4	2	4	3	2	70.2(26)
2	Creates curiosity and gets pupils attention	3	3	2	2	4	3	4	4	3	77.8(28)
3	Raises appropriate questions	4	4	3	3	4	4	3	3	4	91.7(33)
4	Elicits responses to unearth prior knowledge	3	3	3	3	4	3	2	2	3	72.2(26)
5	Links prior knowledge to topic	3	3	2	2	3	2	1	2	2	55.6(20)
6	Create the opportunity for pupils to question	4	3	4	4	3	3	0	3	3	75.0(27)
Total percentage % (freq.)		83.3 (20)	66.7 (16)	62.5 (15)	70.8 (17)	91.7 (22)		70.8 (17)	58.3 (14)	70.8 (17)	79.2 (19)

*Frequency in parenthesis

Key: 0 = No Evidence, 1= Minimum Evidence, 2 = Some Evidence, 3 = Clear Evidence, 4 = Clearer Evidence

Table 17 shows the overall rating of JHS integrated science teachers at the introduction stage of the lesson observation. The rating ranged from 0 (no evidence) to 4 (clearer evidence). The maximum frequency for each indicator was 36 and that of each participant was 24. The respondents‟ total percentage frequency scores on the observation schedule varied between 58.3% (14) and 91.7% (22). This means that all the nine teachers‟ demonstrated high orientation toward the practice of child-centered instruction at the introduction stage of lesson delivery.

It was observed that, the overall rating of the 9 teachers ranges from 55.6% to 91.7%, apart from item 5, over 70% of the respondent used all the instructional practices under introduction stage.

4.5.1 Instructional Practices used by JHS Integrated Science Teachers in the classroom at the presentation stage

This section sought to find out integrated science teachers‟ instructional practices used at the presentation stage of their science lesson in the classroom. This stage involves 22 indicators. The result of the observation schedule is presented in Table 18

Table 18 shows the overall rating of integrated science teachers at the presentation stage of the lesson observation. The rating ranged from 0 (no evidence) to 4 (greater evidence).

Key: 0 = No Evidence, 1= Minimum Evidence, 2 = Some Evidence, 3 = Clear Evidence, 4 = Clearer Evidence

The maximum rating for each indicator was 36 and that of each participant was 88. The respondents‟ total percentage frequency scores on the observation schedule varied between 40.9% (36) and 79.5% (70).

It was observed that, the overall rating of the 9 teachers on the indicators ranges from 5.6% to 80.6 %, this is an indication that teachers in general showed some evidence of practicing learner-centred. Only few showed some evidence of minimum practicing teacher-centred.

The integrated science curriculum recommends the use of inquiry-based (child-centred) approach to teaching in order to develop the necessary scientific experimental process skills of pupils and assist them to build upon their scientific concepts and principles.

Table 18: Matrix of classroom instructional practices used by JHS integrated science teachers in the classroom at the presentation stage

S/N	Presentation Stage	T1	T2	T3	T4	T5	T6	T7	T8	T9	Total
1	Encourages pupils to work together	2	4	1	2	3	2	1	2	2	52.8(19)
2	Provides common experiences	4	4	3	2	4	3	2	3	2	75.0(27)
3	Observes and listens as student raise question	4	3	3	4	4	3	3	2	3	75.0(27)
4	Asks probing question to redirect students	3	3	3	3	4	4	3	2	4	80.6(29)
5	Provide time for students to puzzle through problems	3	3	0	2	3	2	2	1	3	52.8(19)
6	Divides the class for small group work	0	4	1	1	2	0	2	0	0	27.8(10)
7	Adds to the collective memory by recording ideas	4	3	0	2	3	2	2	1	2	52.8(19)
8	Encourages pupils to explain their ideas in their own words	3	3	4	3	4	3	2	2	3	75.0(27)
9	Asks for justification and clarification from pupils	4	3	2	2	4	1	2	3	4	69.4(25)
10	Directs lesson by formally providing definitions	4	3	0	2	4	2	1	2	2	55.7(20)
11	Uses audio-visual or electronic resources	0	0	1	0	0	0	0	1	0	5.6(2)
12	Uses student previous e experiences	3	4	2	3	4	2	2	2	2	66.7(24)
13	Encourages pupil to pupil interaction	3	4	1	3	3	3	3	3	2	69.4(25)
14	Using classroom norms and discussion etiquette	3	4	1	4	3	3	2	2	3	69.4(25)
15	Wait time after asking questions	4	3	1	4	3	3	2	4	3	75.0(27)
16	Questions that challenge another thinking	3	3	0	2	2	2	3	2	2	52.8(19)
17	Questions that justifies	3	2	0	3	1	2	3	2	2	50.0(18)
18	Questions that allow pupils to change their mind	3	4	3	3	2	2	2	3	2	66.7(24)
19	Encourage pupils to use formal labels	2	3	2	2	3	1	2	2	3	55.6(20)
20	Encourage pupils to apply or extend concept	4	3	3	3	3	2	3	3	3	77.8(28)
21	Remind pupils of alternative explanations	3	4	2	2	3	3	4	4	4	80.6(29)
22	Refer pupils to existing data and evidence	3	3	3	2	2	2	2	2	2	58.3(21)
Total	**% freq.**	**73.9 (65)**	**79.5 (70)**	**40.9 (36)**	**61.4 (54)**	**72.7 (64)**	**53.4 (47)**	**54.5 (48)**	**55.7 (49)**	**60.2 (53)**	

*Frequency in parenthesis

4.5.3 Integrated Science Teachers assessment practices used by integrated science teachers in the classroom at the evaluation stage

This part sought to find out integrated science teachers carry out assessment in their classrooms since instruction and assessment goes on concurrently. Table 19 shows the percentage frequencies of integrated science teachers‟ use of assessment strategies to evaluate their lessons. The rating ranged from 0 (no evidence) to 4 (greater evidence).

Table 19: Matrix of assessment practices used by integrated science teachers in the classroom at the evaluation stage

S/N	Evaluation stage	T1	T2	T3	T4	T5	T6	T7	T8	T9	Total %(f)
1	Observes pupils as they apply new concepts	2	4	2	3	3	3	2	3	3	69.4(25)
2	Compares ideas of pupils to concepts taught	4	4	1	3	4	2	2	2	2	66.7(24)
3	Uses different assessment techniques	3	3	3	4	3	4	4	3	3	83.3(30)
4	Allows pupils to assess their own learning	4	3	2	3	3	2	3	4	2	72.2(26)
5	Asks open ended questions	3	4	2	2	4	4	3	2	3	75.0(27)
6	Evaluates collective memory of the class	3	4	3	3	4	3	4	3	2	80.6(29)
7	Brings closure to lessons	3	4	3	4	4	4	2	4	4	88.9(32)
Total % freq.		78.6 (22)	92.8 (26)	57.1 (16)	78.6 (22)	89.3 (25)	78.6 (22)	71.4 (20)	75 (21)	**67.8** (19)	

*Frequency in parenthesis

Key: 0 = No Evidence, 1= Minimum Evidence, 2 = Some Evidence, 3 = Clear Evidence, 4 = Clearer Evidence

The maximum frequency for each indicator was 36 and that of each participant was 28. The respondents" total percentage frequency score on the observation schedule varied between 57.1% (16) and 92.8% (26). Respondent T2 obtained 92.8% (26) being the highest and respondent T5 also obtained 89.3% (25). Respondents T1, T4 and T6 obtained 78.6% (22) and respondent T8 obtained 75% (21). Respondent T7 obtained 71.5% (20) and respondent T9 obtained 67.8% (19). Also respondent T3 obtained the lowest among the respondents 57.1% (16). This means that all the respondents showed evidence of using child-centred assessment techniques to evaluate their lessons.

It was observed that, the percentage frequency of the 9 teachers on the indicator ranges from 66.7% to 88.9%. This means that the teachers showed clearer evidence of bringing closure to their lessons. The integrated science teachers in generally showed some evidence of using child-centered assessment strategies to evaluate their lessons.

4.6 Research Question 4: What assessment Practices do Junior High School Science Teachers use in their Classrooms?

The data obtained from to part III of the questionnaire was used to answer research question four. The participant response were organized into Frequency count and converted into percentages and presented in tables

4.6.1 Integrated science teachers' design and organization of classroom assessment task in a term

Section A of part III sought to find out when integrated science teachers organize assessment in a term and when they assessed pupils. It also sought to find out the forms of assessment used by teachers. The results of analysis of participants" responses are presented in Tables 20 – 25.

The data in Table 4.16 indicate that all integrated science teachers organized their respective assessment tasks but at different times of the term.

Table 20: Periods integrated science teachers organize assessment in the term

Periods Organize Assessment Task	Frequency	Percentage (%)
Start of the term	7	9.8
Weekly	13	18.4
Monthly	20	28.2
Midway through the term	31	43.6
Total	**71**	**100**

*Four participant did not provide a response.

The results show that, only 9.8% (7) of the teachers organized their assessment tasks at the beginning of the term. However, 18.4% (13) and 28.2% (20) teachers planned their assessments tasks weekly and monthly respectively. Most of the teachers 43.6% assessed their pupils Midway through the term.

The results in Table 21 indicate the frequency at which teachers assessed their pupils at various stages of instruction.

Table 21: Frequency at which integrated science teachers assess pupils at various stages during instruction

Stage of Instruction Teachers Assess Pupils	**Frequency**	**Percentage (%)**
Introduction stage	12	16.2
Presentation stage	10	13.5
Concluding stage	44	59.5
Throughout the lesson	8	10.8
Total	74	**100**

*One participant did not provide a response.

Teachers indicated various stages at which they assessed their pupils. Table 21 indicates that about more than half (59.5%) of the teachers assessed their pupils at the conclusion stage of the lesson. About 16.2% of the teachers assessed their pupils at the introduction stages of s lesson while 13.5% of the teachers assessed their pupils at the presentation stage. But only 10.8% of the teachers assessed their pupils throughout the lesson. This suggests that majority of the teachers failed to implement the recommendation.

The results in Table 22 indicate the time at which teachers assessed their pupils through school Base Assessment.

Table 22. Times JHS science teachers assessed their pupils through school base assessment

How often students are assessed	Frequency	Percentage
At the end of each lesson	12	16.0
At the end of a topic	9	12.0
At the end of a unit	13	17.3
At the end of the term	41	54.7
Total	**75**	**100**

*two participant did not provide a response.

Table 22 indicates that 16.0% of the teachers assessed their pupils at the end of a lesson and also 12% at the end of a topic. 17.3% of the teachers assessed their pupils at the end of a unit while 54.7% of the teacher assessed their pupils at the end of the term.

The results in Table 23 indicate the number of assessment task teachers give to pupils in a term.

Table 23: Number of assessment tasks given by teachers in a term

Number of assessment tasks	Frequency	Percentage (%)
0 – 10	8	10.9
11 – 20	16	21.9
21- 30	34	46.6
31 – 40	11	15.1
40 – above	4	5.5
Total	**73**	**100**

*two participant did not provide a response.

The results show that only 5.5% (11) of the teachers conducted assessment tasks of 40 or more while 10.9% (8) of the teachers 10 or less assessment tasks in a term. Also, about 46.6% of the teachers conducted between 21 and 30 assessment tasks in a term.

The results in Table 24 indicate the time at which Integrated Science teachers‟ design assessment tasks.

Table 24: Times Integrated Science Teachers Design Assessment Tasks

Times assessment tasks are designed	Frequency	Percentage (%)
During lesson preparation	35	46.7
During instruction	23	30.7
After instruction	17	22.6
Total	**75**	**100**

*two participant did not provide a response.

The results indicate that, 46.7% (35) of the teachers designed their assessment tasks during lesson preparation while 30.7% (23) of the teachers design assessment tasks during instruction. Also, 22.6% (17) teachers design their assessment tasks after instruction. The results show that, a few number of integrated science teachers (22.6.%) did not plan their assessment tasks appropriately. This is because designing assessment tasks should be an integral part of lesson preparation and presentation.

The results in Table 25 indicate Consideration that inform the content of Integrated Science teachers‟ assessment tasks.

Table 25: Considerations That Inform The Content Of Teachers' Assessment Task

Consideration	Frequency	Percentage (%)
Content of the topic	18	24.6
Pupils knowledge level	16	21.9
Objectives of the lesson	29	39.7
Profile dimensions	4	5.5
Evaluation questions in the syllabus	6	8.3
Others	0	0.0
Total	**73**	**100**

*two participant did not provide a response.

The results in Table 25 indicate that as many as 39.7% (29) of the teachers considered the objectives of the lesson when developing their assessment tasks. However, 24.6% (18) and 21.9% (16) teachers have their assessment tasks based on the content of the topic and pupils‟ knowledge levels respectively. Also, 5.5% (4) and 8.3% (6) teachers‟ design their assessment tasks based on the profile dimension and evaluation questions in the syllabus respectively. However, it is recommended in the integrated science syllabus that the content of assessment tasks should be guided by the objectives of the lesson which reflect the profile dimensions. This means that a some of the integrated science teachers (39.7%) designed their assessment tasks based on the objectives of the lesson. This showed that some of the teachers had inadequate knowledge of the requirement of the syllabus with regard to designing assessment tasks while the other did not adhere to the requirement.

4.6.2 Types of tasks teachers give to their pupils

Section B of part III of the questionnaire was designed to find out the type of tasks teachers gave to their pupils. It will also find out the profile dimension teachers examine.

The results presented in Table 26 indicate the types of assessment tasks teachers give to their pupils.

Table 26: Types of assessment tasks teachers give to their pupils

Types of assessment tasks teachers give to pupils	Frequency	Percentage (%)
Class exercises	71	94.7
Homework	67	89.3
Project work	69	92.0
Class test	72	96.0
End of term examination	73	97.3

*two participant did not provide a response.

Over 90% of integrated science teachers gave 4 different types of assessment tasks to their pupils. This means that teachers gave different assessment tasks to their pupils as recommended by the integrated science curriculum. However, homework recorded the lowest (89.3%) though it is recommended in the integrated science syllabus that at least one should be given to pupils each week. This shows that, few of integrated science teachers do not follow the SBA recommendation of the integrated science syllabus with regard to home work.

The results in Table 27 indicate the frequency and types of assessment JHS Integrated Science teachers gives in a term.

Table 27. Frequency and types of assessment JHS science teachers give in a term. (n = 75)

Range of NO of task given	Class test	Homework	Project	Class exercise	End of term test
0 – 10	67 (89.3)	53(70.7)	73(97.3)	55 (73.3)	75 (100)
11 – 20	8(10.7)	15 (20.0)	2(2.7)	12 (16.0)	
Above 20		7 (9.3)		8 (10.7)	

*two participant did not provide a response.

Table 27 indicates that 89.3% (67) of the teachers gave at least 10 class test while 10.7% (8) of the teachers gave between 11 and 20 class test. None of the teachers gave above 20 class test. On the other hand, 70.7% (53) of the teachers gave at least 10 home works while 20.0% (15) of the teachers gave between 10 to 20 home work. Only 9.3% (7) of the teachers gave homework above 20. Also 97.3% (73) of the teachers gave project work at least 10 while 2.7% (2) of the teachers gave project work between above 11. The most common assessment task teachers gave to their pupils was end of term test. Almost all the teachers gave end of term task to pupils.

The results in Table 28 indicate profile dimension stated and examined by JHS Integrated Science teachers

Table 28. Profile Dimensions stated and examined by JHS science teachers. (n=75)

Profile dimensions	Stated		Examined	
	Freq. of responses	**%**	**Freq. of responses**	**%**
Knowledge and comprehension	75	100	70	93.3
Application of knowledge	75	100	69	92.0
Experimental and process skills	75	100	59	78.7

*two participant did not provide a response.

Tables 28 indicate that all the teachers (100%) stated the profile dimensions. Regarding the profile dimensions stated in the science syllabus and those examined by teachers, 90% of the teachers examined their pupils on knowledge and comprehension and application of knowledge and 78.7% examined on Experimental and process skills.

The results in Table 29 indicate Integrated Science Teachers" reasons for examine the profile dimension

Table 29. JHS Science teacher's reasons for examination of profile dimensions (n=75)

Categories of responses	No. of responses	Percentage
It helps to know students ability to recall and express themselves	23	30.7
It help teachers to know students‟ level of understanding	11	14.6
It is in the syllabus	13	17.3
It enables pupils think critically	4	5.3
It gives pupils a wide perspective of the learning process	2	2.7
BECE questions are based on them	17	22.7
It provides a quick marking options	5	6.7
Total	75	100

*two participant did not provide a response.

Table 29 Indicates that about 30.7% (23) of the teachers stated that „It helped to know pupils ability to recall and express themselves‟ while 14.6% (11) of the teachers stated „It helped them to know students‟ level of understanding‟. Also 17.3% (13) of the teachers stated „It was in the syllabus while 5.3% (4) of the teachers stated „It enabled pupils to think critically.‟ Again another 2.7% (2) of the teachers stated „It gave pupils a wide perspective of learning process‟ while 22.7% (17) of the teachers stated „BECE questions were based on them‟. But only 6.7% (5) of the teacher state „It provided a quick marking options‟.

The results in Table 30 indicate range of time Integrated Science Teachers‟ give to pupils to pupils to complete class assignment.

Table 30: Range of time teachers gives to pupils to complete class assignment

Range of time given by teachers	Frequency	Percentage (%)
5 – 10 minutes	8	10.7
11 – 15 minutes	14	18.6
16 – 20 minutes	20	26.7
21 – 25 minutes	10	13.3
26 – 30 minutes	11	14.7
Above 30 minutes	12	16.0
Total	**75**	**100**

*two participant did not provide a response.

The results in Table 30 show that 26.7% (20) of teachers gave pupils between 16 – 20 minutes to complete class assignment, 18.6% (14) of teachers give between 11 -15 minutes while 10.7% (8) of the teachers give pupils between 5-10 minutes to complete class assignment. Moreover, 16% (12) of teachers give pupils above 30 minutes to complete class assignment. This means that integrated science teachers give pupils different time to complete their class assignments.

4.6.3 Types of Feedback Science teachers give to their pupils

Section C of part III of the integrated Science Teachers‟ Curriculum Knowledge (ISTCK) questionnaire was designed to find out from integrated science teachers the type of feedback they gave to their pupils and what the feedbacks were centred on. This was to help the researcher to find whether the teachers‟ feedback promoted pupils‟ learning. The results of the analysis of the participant‟s responses to the questionnaire items are presented in Tables 31-36.

The results in Table 31 indicate the types of feedback Integrated Science Teachers‟ gives to their pupils after assessing their work.

Table 31: Types of Feedback teachers gives to pupils after assessing their work

Types of feedback given to pupils	Frequency	Percentage (%)
Oral feedback	11	14.7
Written feedback	21	28.0
Both oral and written feedback	43	57.3
Total	**75**	**100**

*two participant did not provide a response.

The results presented in Table 31 indicate that 57.3% (43) of the teachers gave both oral and written feedback to their pupils while 28.0% (21) and 14.7% (11) of the teachers gave only written and oral feedback respectively.

The results in Table 32 indicate pupils reaction to the feedback teachers give after assessing them.

Table 32. JHS pupils' reactions to the feedback teachers gave. (n=75)

Categories of responses	No. of responses	Percentage
Pupils take it as normal	15	20.0
Pupil use them to correct mistakes	13	17.3
pupils get excited	12	16
pupils follow what feedback says	6	8
pupils" reactions depends on the nature of feedback	7	9.3
pupils become sad	10	13.3
They promptly react to comments	4	5.3
Challenge teachers on the feedback	8	10.7

*two participants did not provide a response.

Table 32 indicates that about 20.0% of the teachers stated that pupils took the feedback normal while17.3% of the teachers stated pupils used the feedback to correct mistakes, Also about 16.0% of the teachers stated that pupils got excited and 8.0% of pupil follow what feedback says, 9.3% (7) of some pupils" reaction depended on the nature of feedback. Also 13.3% (10) of the pupils become sad while 5.3% (4) of the teacher stated pupils react promptly to comments and 10.7% (8) of pupils challenged the feedback teachers" gives.

The results in Table 33 indicate the focus of the integrated science teachers" feedback.

Table 33. Focus of Integrated Science Teacher's Feedback

Focus of feedback	Frequency	Percentage (%)
Centred on praising pupils	30	40.0
Centred on task	21	28
Centred on both task and pupils	11	14.7
No response	13	17.3
Total	**75**	**100**

*two participant did not provide a response.

The results in Table 33. Indicate that 40.0% (30) of teacher"s feedback was centred on praising pupils, 28.0% (21) of the teachers had their feedback centred on task while 14.7% (11) of the teacher"s feedback was centred on bother tasks and pupils. However, 17.3% of the teachers did not indicate any feedback to their pupils. Teachers" feedback should focus on task to ensure that, pupils who had the task wrong could do their corrections. However, responses of teachers indicate that, majority of them based their feedback on praising pupils while others also did not indicate what their feedback was based on.

The results in Table 34 indicate nature of task centred feedback from integrated science teachers to pupils

Table 34: Examples of task centred feedback from integrated science teachers' to their pupils

Categories of responses	Frequency	Percentage (%) Freq.
Good work	17	22.7
Very Good work	13	17.3
Excellent work done	14	18.7
Do independent work	7	9.3
Check your spellings	6	8.0
Do the work again	10	13.3
No response	8	10.7
Total	**75**	**100**

*two participant did not provide a response.

Table 34 indicates that 22.7% of the teachers wrote „Good work" when pupil"s work was marked, 17.3 % and 18.7% of the teachers wrote „excellent work done" and „very good respectively" while 9.3% of the teachers wrote „do independent work" and 8.0%

wrote check your spellings. About 13.3% of teachers wrote „do the works again‟ while 10% did not indicate the nature of their task centred feedback. The results show that majority of integrated science teachers gave task centred feedback that would likely motivate pupils to work harder next time.

The results in Table 35 indicate examples of pupils-centred feedback from integrated science teachers to pupils.

Table 35. Examples of Pupil-Centred Feedback by JHS Science Teachers. (n=75)

Examples of feedback	Frequency	Percentage
Be serious with work	5	6.7
You are doing well	6	8.0
Keep it up	9	12.0
Good performance	14	18.7
Excellent	16	21.3
Very good and good	11	14.6
You can do better	5	6.7
More room for improvement	3	4.0
Other responses	6	8.0
Total	75	100

Some teachers gave more than one response.

Table 35 indicates that 6.7% of the teachers gave comment like "be serious with your work and you can do better" while 8.0% of the teachers also gives "you are doing well" and others responses respectively. Also 12.0% of the teachers wrote keep it up while 18.7% of the teachers wrote good performance. About 14.6% of the teachers give positive comment like "very good and good".

The results in Table 36 indicate integrated science teachers‟ pracyise of School Base Assessment.

Table 36: Integrated Science Teachers' practice of School Based Assessment (SBA)

Practice of SBA	% and freq. of teachers' responses				
	Always	Very Often	Sometimes	Rarely	Total
I mark as pupils work	48.0(36)	29.3(22)	13.3(10)	9.4(7)	100(75)
I allow pupils to complete their assignment and submit later	26.7(20)	25.3(19)	41.3(31)	6.7(5)	100(75)
I return their marked work the same day	56.0(42)	13.3(10)	21.3(16)	9.4(7)	100(75)
I give it out books during the subsequent lesson	22.7(17)	16.0(12)	40.0(30)	21.3(16)	100(75)
Pupils exchange and mark their own work	4.0(3)	12.0(9)	28.0(21)	56.0(42)	100(75)
How often do you give feedback?	16.0(12)	41.3(31)	34.7(26)	8.0(6)	100(75)
How often do you discuss tasks with your pupils after marking?	44.0(33)	28.0(21)	24.0(18)	4.0(3)	100(75)

*Frequency in parenthesis

Table 36 indicates that 48.0% (36) of the teachers always marked pupil‟s exercises as they are answering. Also, 41.3 (31) of the teachers sometimes marked pupils work as they are answering while about 9.4% (7) of the teachers allow pupils to compete their assignment and submit later.

On the other hand, 56.0% (42) of the teachers always marked pupils‟ work and returned marked work to pupils on the same. Also 56.0% of teachers rarely made their pupils to exchange their work and mark.

Also, 44.0% (33) of teachers always discussed tasks with pupils while 28.0% (21) of the teachers very often discussed tasks with pupils after marking. The results showed that majority of the teachers gave feedback to pupils on tasks they performed. However, out of about 56% of teachers who always marked and returned pupils work on the same day, only about 44% always discussed tasks with pupils after they had marked their work. Also, since some teachers were unable to mark and return work to pupils on the same day, they preferred to give written feedback to pupils. This means that about half of the teachers do not always discuss pupils" task results with them which can adversely affect performance because pupils are able to correct their mistakes when results are discussed with them.

4.6.4 Analysis of Science Teachers use of Pupils' Assessment Results

Section D of part III of the questionnaire was designed to find out what pupils" assessment results were used for. This is to enable the Researcher find out teachers" views on the purpose of assessment. The results are presented in Tables 37 and 38

The results in Table 37 indicate integrated science teachers" use of pupils assessment results.

Table 37. JHS Science Teachers use of Pupil's Assessment Results (n=75)

Uses of Students' Assessment Results	No. of Responses	Percentage
To improve teaching	14	18.7
To give feedback to pupils	10	13.3
To make judgment	38	50.7
To inform parents about wards performance	9	12.0
Other	4	5.3
Total	75	**100**

*two participant did not provide a response.

Table 37 indicates that a little over half of the teachers (50.7%) used the assessment results to make judgment on while 18.7% of the teachers used assessment results to improve teaching. Also 13.3% of the teachers used assessment results to give feedback pupils while 12% of the teachers used assessment results to inform parents about their wards‟ performance. But 5.3% of the teachers gave other reasons. Some of the other reasons they gave were for awarding marks, for promotions, to measure output of work and to monitor learning. This means that integrated science teachers usually use assessment to make judgment and not necessary to improve learning.

The results in Table 38 indicate reasons parents are interested in their wards results

Table 38. Reasons parents are interested in their wards assessment results (n=75)

Responses	**Freq. of resp.**	**Percentage**
To know wards performance	44	58.7
To help their wards with academic difficulties	14	18.6
To check wards academic progress	11	14.7
Other responses	6	8.0
Total	**75**	**100**

*two participant did not provide a response.

Table 38 indicates that about 58.7% of the teachers stated that it helped parents to know the performance of their wards while 18.6% stated it enabled parents to help wards with academic difficulties. Also 14.7% of the teachers said it helped the parents to check their wards academic progress. But 8% teachers gave other different reasons.

Also the results indicated that majority of parent used assessment results to find out their ward academic performance. This result indicates that the majority of the teachers concentrated mainly of assessment for learning but not assessment of learning.

CHAPTER FIVE

DISCUSSION

5.0 Overview

This chapter discusses the findings of the study on integrated science teachers" curriculum knowledge, classroom instructions and assessment practices. First, the findings on integrated science teachers" curriculum knowledge are discussed. This is followed by discussion of the findings on integrated science teachers" classroom instructional practices. Thirdly, the findings on the relationship between integrated science teachers" background factors and their knowledge of the content of the integrated science curriculum discussed. Finally, the findings on the integrated science teachers" classroom assessment practices are discussed.

5.1 Integrated Science Teachers' Knowledge of the Integrated Science Curriculum

Teacher curriculum knowledge holds general pedagogical knowledge, knowledge of curriculum materials, knowledge of learners, knowledge of educational context as well as knowledge of educational goals and objectives (Shulman, 1986). The main aim of the integrated science curriculum is to equip children with the scientific literacy and positive attitudes and develop the spirit of curiosity, creativity and critical thinking (Curriculum Research and Development Division [CRDD], 2007). Teachers who are the main implementers of the curriculum are expected to have knowledge of the JHS science curriculum for effective science instruction and assessment. Especially they should be knowledgeable in the rational, subject matter (content), materials and the recommended instructional strategies. This knowledge refers to the teacher"s knowledge about curriculum materials, content and the ability to use these elements effectively during instruction and assessment to enhance teaching and learning. It also includes the interaction between subject matter knowledge, pedagogical content knowledge and teachers" practical theories. It is assumed that what teachers know and what they believe has influence on their decision in planning prior to teaching and carrying out their plan. This is because teachers" curriculum knowledge influences their instructional and assessment practices.

The finding indicates that at least all the teachers had one of curriculum materials in their schools. Most of the teachers had the main curriculum materials such as syllabus, textbooks and teachers guide in their schools. Also, it came to light that all teachers lacked at least one curriculum material or the other in their schools which adversely affected their teaching and assessment.

Moreover, majority of the teachers 92.0% always used curriculum materials in their lesson preparation and presentation. (See Table 6). This means that few teachers taught without the use of curriculum materials such as syllabus, teachers" guide and textbook.

Also, about 67.1% of teachers knew the rational for teaching integrated science at the JHS level and 98.6% of the teachers were able to indicate the number themes in the science curriculum. Also, almost all the teachers (73) of teachers knew the number of periods allocated for teaching both theory and practical aspect of integrated science. This means that majority of teachers taught with recourse to the dictates of the curriculum which states that four periods out of the total of six periods per week should be allocated to teaching practical while the remaining periods allocated for teaching theory (CRDD, 2012).

Also, about 82.2%, 97.3% and 94.5% of the teachers knew the weight of profile dimensions that have been specified for teaching, learning and testing respectively.

(See Table 7). The integrated science syllabus dictates that, the weight of the profile dimension of knowledge and Comprehension should be 20%, application of knowledge, 40% and experiment and process skills 40%. The implication is that, majority of the teachers are likely not to emphasize the weight of the profile dimensions in their teaching and assessment (CRDD, 2012). The profile dimensions give a direction as to the relative emphasis that the teacher should give in the teaching, learning and testing. More emphasis (40%) have been placed on "application of knowledge and experimental and process skills" to give pupils the necessary scientific skills to be able to build their store of scientific concepts and principles. Also, 20% emphasis has been placed on knowledge and comprehension (CRDD, 2012).

Also, a little over half of the teachers (53.4%) were aware of the instructional approach recommended for teaching integrated science which is child-centred. The integrated science curriculum emphasizes on enquiry processes of science instruction (CRDD, 2012). Inquiry-based instruction promotes child-centered instruction where children are actively engaged to develop scientific concepts.

A good number of integrated science teachers (64.4%) exhibited fair knowledge of the assessment approach recommended in the curriculum (see Table 7). The integrated science curriculum recommends the use of both formative and summative assessment procedures based on the profile dimensions. However, the SBA forms the practical test aspect of assessment about 64.4% of the teachers practice SBA in the lesson delivery.

In a nut shell, integrated science teachers in the Effutu Municipality of the Central region of Ghana had not taken time to study the curriculum to know and understand its requirements and content structure (See Table 7). The evident from the findings shows that, most of the teachers teach without adequate adhering to the requirements of the curriculum. This means there is a gap which that affects integrated science teaching practices.

5.2 Integrated Science Teachers' Content Knowledge of the Integrated Science Curriculum

This section discussed integrated science teachers" content knowledge of the integrated science curriculum. Teachers were asked to group the various topics under the six themes in the syllabus. Greater number of teachers has adequate knowledge on the organization of integrated science topics under the various themes. For instance, about 93.3%, 92.0%, and 90.7% of the teachers were able to group matter, farming system, basic electronic and respiratory system of human correctly under each themes in the JHS one syllabus.

With regard to the JHS one syllabus, only 81.3% and 73.3% of the respondents were able to group introduction of integrated and measurement correct theme (introduction to science) (See Table 8). The responses to questionnaire indicated that about 53.3% of teachers were able to group Pest and Parasites under the interaction of matter in the JHS two syllabus. The result shows that majority of the teachers were able to group all the topics under their respective themes. (See Table 9). Also 52% of the teachers were able to group science related industries correctly in the JHS three syllabus. Majority of the teachers had adequate knowledge of organization of some topics under the various themes in the JHS three syllabus (See Table 7).

The findings showed that integrated science teachers" had adequate knowledge of the content of the integrated science curriculum with regards to their ability to identify topics and group them under appropriate themes. However, all the teachers admitted they encountered some difficulties when teaching content topics (See Tables 11 - 15). For example, the entire teachers indicated that they had difficulties of teaching topics like basic electronics, physical and chemical change, Energy and Acids and bases. The teachers" acceptance of difficulties in teaching some topics indicates that there are gaps in teaching science subject.

The responses to questionnaire indicated that, some of the reason teachers taught science with ease because some of the science topics content are not technical (See Table 14). Some of the teachers stated more than one reason why they had difficulties in teaching the integrated science.

Some of the common reasons the teachers gave were that they did not have enough knowledge on those topics especially which involved more formulas, calculations and difficult terminologies (See Table 4.15). This was more pronounced among the professional teachers with low science background. Therefore, teachers" inability to teach these topics effectively may affect the implementation of the integrated science curriculum. The findings also buttressed the assertion that without the essential knowledge base of subject matter, teachers are simply unable to produce effective instruction (Grossman, 1992).

5.3 Junior High School Science Teachers' Classroom Instructional Practices.

Inquiry-based science teaching and learning is a replication of authentic scientific investigation and a means of channeling natural human curiosity toward specified learning outcome. The inquiry based child-centred instruction requires teachers with very strong curriculum content knowledge. Child-centred classrooms are full of curiosity, conception and misconceptions (Collins & O‟Brien, 2003). Therefore, teachers should be more knowledgeable to guide pupils to solve problems, eliminate misconceptions and build on conceptions. Proper implementation of child centred instruction can lead to increased motivation in the pupils to learn, greater retention of knowledge, deeper understanding, and more positive attitude toward the subject being taught (Collins & O"Brien, 2003).

The recommended instructional method in Ghanaian basic schools is the child-centred approach. Child centred instruction is an instructional approach in which pupils influence the content, activities, materials and pace of learning. This instructional approach places the pupil (learner) at the centre of the learning process and the instructor provides pupils with opportunity to learn independently from each other and coaches them in the skills they need to do so effectively.

The results from the observational guide showed that majority of integrated science teachers in the Effutu Municipality of the Central Region generally adopted child-centred teaching practices at the introduction stage of the lesson. Teachers used previous knowledge level of their pupils as a main point for their lessons and created the basis for inquiry-based child-centred instructional approach.

It was observed that, the overall rating of the 9 teachers on the first indicator (states the purpose and expectations for learning) was 70.2% (See Table 17). All the teachers stated the purpose and expectations of the lesson and had ratings from 1 to 4. Also, the total percentage score on the second indicator was 77.8%. This shows that, majority of the teachers created curiosity to get pupils attention during integrated science lessons which helped draw pupils" attention and participation in the lesson. 92% of the teachers were able to raise appropriate questions during the lesson. However, the total score on the fourth indicator (elicits responses to unearth prior knowledge) was 72.2%. Eliciting responses to unearth prior knowledge would help teachers to relate science concepts to real contexts of the pupils. This will facilitate the pupil‟s understanding of the science concepts. This supports the findings of Shank cited in Ako (2017) that, inquiry-based child-centred instruction with authentic questions generated from student‟s experiences is the central strategy for teaching science at the basic schools. This approach is consistent with the constructivists‟ view that learning is a process of building up of structures of experience where prior knowledge and experiences add to new understandings (Shank, 2006). The outcomes are also consistent with the recommendations of UNICEF (2014) which states that, child-centred instruction demands that lessons shall be built on previous knowledge and skills of students.

In addition, the total percentage score on the six indicators was 75.0%. This showed that majority of the teachers did well in creating opportunity for the pupils to question during the science lesson. From the lessons observed at the introduction stage all the teacher exhibited some level of applying child centred method in their teaching.

Moreover, at the presentation stage only 52.8% of the teachers encouraged their pupil‟s to work in together. But the group activities did not involve the use of science materials for hand on activities. The pupils were only engaged in group discussions about the topics being taught.

Though teachers observed and listened as pupils raise questions during group discussion, almost 80.6% of the teachers asked probing questions that redirected pupils‟ thinking. Also, it was observed that 52.8% of the teachers provided time for students puzzle through problems in other to generate solutions, while only few (27.8%) teachers observed divided their class small group work. Group activities that offer pupils opportunities to dialogue and to develop skills of influence through communication were absent. These classroom realities therefore constitute gaps between the intended science curriculum and the implementation. This implies that the teachers classroom were not learner-centred. These findings are consistent with the findings of Hundeland (2011) who reported that teachers who are positive towards elements of inquiry in their teaching provided opportunity for students to work together in groups.

Overcrowding in Junior High School classrooms, poor infrastructure and limited furniture in the Junior High School classrooms hindered classroom instructional management during instruction and this affected instructional practices. About 75% of the teachers encourage pupils to explain concepts in their own words. They did not provide them with definitions and key points from text books and pamphlets. This indicates that most of the teachers have high knowledge of the subject matter.

Also majority of the teachers observed did not used audio-visual or electronic resources to aid in their lesson delivery, the teachers were found explaining everything to the learners. Integrating digital media into the classroom according to Garbett (2003) is one of the contemporary methods of teaching that promotes learner involvement in class. They proceed to say that several software packages have been developed to give students practice to test and evaluate themselves. For instance, AKI OLA has developed software package for teaching and learning of integrated science. This software helps the pupils to extend and challenge their understanding. Inadequate science resources (science materials and equipment), laboratories and lack of funds to purchase or improvise them influenced the teachers‟ lessons presentation and the right instructional strategy to adopt in teaching of science.

Teachers are encouraged to apply classroom norms or routine in their classrooms to create conducive environment that helps the learners to concentrate. About 69% of the teachers were able to use classroom norms. Also, 52% of the teachers were able to give questions that challenged the thinking ability of the learners. According to Osei (2004) integrated science teachers assumes primary responsibility for the communication of knowledge to students.

Also, majority of the teachers observed neither encouraged their pupils to use formal labels nor engaged them to explore materials to come up with their own findings contrary to the findings of DeJarnette (2012) that learners should be guided to create their own knowledge through inquiry or scaffolding interactions between teacher and child.

The results of the observational guide at the evaluations stage showed that majority of the teachers showed evidence of engaging pupils to apply new concepts to their daily lives which is in line with the recommendations of the integrated science curriculum.

Furthermore, greater number of teachers asked open ended questions to evaluate their lessons which indicated a good assessment approach. Also, 88.9% of the teachers observed generally brought closure to lesson. The results generally showed that, integrated science teachers practiced formative assessment during their science lesson.

5.4 Integrated Science Teachers' Background factors and their Content Knowledge of the Integrated Science Curriculum

Results from the questionnaire showed that majority of integrated science teachers in the Effutu Municipality at the time of this study were males (72%). This means that more male teachers are usually posted to the JHS level, therefore men represent a significant majority of the teaching work force at the JHS level in the Effutu Municipality. The result indicated that integrated science teachers in the Municipality are professionally trained and are therefore likely to have adequate knowledge of the integrated science curriculum.

Only about 2.7% and 40% (Table 5) of the teachers had specialized training in science related courses such as B.Ed Science education and B.Ed Basic Education (specialized in science). This means that majority of integrated science teachers were generalist from the colleges of education and Universities offering education courses. The results showed that professional qualification was the only background factor which correlated positively and significantly with integrated science teachers‟ content knowledge of the integrated science curriculum (See Table 16). Even though correlation does not show causation, it indicates that, as teachers‟ professional qualification increases, their content knowledge of the curriculum will increases. This findings, confirms that of Ngman-Wara (2015) who found that, professional qualification had a statically significant correlation with science teachers‟ knowledge of content knowledge and also confirms the findings of Van Driel and Berry (2012) who stated that, curriculum content knowledge can be strengthened through teaching experience, professional development and teacher collaboration. This implies that professional qualification and continuous professional development add to integrated science teachers‟ curriculum knowledge base.

However, there was no positive statistical significant correlation between integrated science teachers‟ content knowledge of the integrated science curriculum and academic qualification and years of teaching experience as well as gender. The findings mean that, teachers‟ need to participate in professional development training workshops and in-service training programmes on integrated science curriculum. These are likely to improve their content knowledge of the integrated science curriculum.

5.5 Junior High School Integrated Science Teachers' Assessment Practices.

The SBA consists of End-of-month tests, assignments (specially designed for SBA) and Project. Apart from the SBA, teachers are expected to use class exercises and home work as processes for continually evaluating pupils‟ class performance, and as means for encouraging improvements in learning performance (CRDD, 2012; pg xiv). Also the curriculum recommends that at the JHS level, learners are expected to write reports as part of their homework assignments. In writing a report on an experiment or any form of investigation, the learners has to introduce the main issue in the investigation, project or report (Bartels, 2000).

The information obtained from science teachers‟ organisation of assessment tasks indicated that about 43.6% of the teachers designed their assessment task midway through the term while the rest designed their assessment tasks either at the start of the term, weekly, or monthly. None of the teachers indicated they designed their assessment tasks daily.

Also the results obtained indicated that half of the teachers (59.5%) indicated that they assessed their pupils at the conclusion stage of the lesson and the rest (40.5%) of the teachers assessed their learners throughout the lesson from (introduction stage, presentation, or at the end of instruction). Teachers are expected to assess pupil‟ throughout the science instruction but results showed that they were not practicing that. This implies that most teachers do assessment of learning and not assessment for learning. As indicated by Black (1996), assessment should be regular for teachers to constantly monitor students" progress and weaknesses for the necessary action to be taken.

All teachers indicated that they assessed their pupils but their forms of assessment were purely summative (Table 22). Summative assessment is the assessment that comes at the end of the course or unit of instruction to assess the final outcome of that unit in terms of student learning. It is most frequently based upon cognitive gains and rarely takes into consideration other areas of the intellect (Trowbridge, Bybee & Powell, 2004).

The results indicated that almost all the teachers (92%) assessed their pupil through project work. The emphasis on the project work is to improve pupils" learning by encouraging them to produce works and other items of learning using appropriate process skills, analysing information and other forms of data accurately and make generalizations and conclusions. Therefore, if the majority of the teachers assessed pupils on that, the pupils would develop experimental and process skill.

Profile dimension' is a psychological unit for describing a particular learning behaviour. Each of the specific objectives in this syllabus contains an "action verb" that describes the behaviour the pupil will be able to demonstrate after the instruction (CRDD, 2012). Knowledge, Application etc. is dimensions that should be the prime focus of teaching and learning in schools. It has been realized unfortunately that schools still teach the low ability thinking skills of knowledge and understanding and ignore the higher ability thinking skills. Applications of knowledge and Experimental and process skills have equal weight that is higher than the weight for Knowledge and Comprehension. This means that the second and third dimensions are considered more important and will therefore need more emphasis in the teaching and testing system (CRDD, 2012: p x)

The results obtained indicate that 39.7% of the teachers indicated that they selected their assessment task from objective of lesson in the syllabus; others also indicated they select already made questions from textbook. Only 24.6% of the teachers indicated they assessed their pupils based on the topical content in the science syllabus. Though teachers can use these questions but test items that have been used in examinations or class work may also be modified and stored in the item bank (CRDD, 2012: p xiii).

The findings indicated that almost about half (93.3%) of the teachers assessed their pupils on Knowledge and Comprehension while only about 92.0% and 78.7% of the teachers assessed pupils on Application of Knowledge and Experimental and process skills respectively. As recommended in the curriculum, the profile dimension weights indicate 20% of the total marks are allocated to Knowledge and Comprehension, 40% of the total marks are allocated to each of Application of Knowledge and Experimental and Process Skills. Since application of knowledge and experimental and process skill constitute 80% of the total assessment marks, teacher"s hesitance to assess pupils on such area of profile dimension could affect pupils" performance. Pupils usually perform well in objectives but their performance in subjective and practical is very poor (WAEC, 2017). Effective feedback on assessment informs both teachers and learners to improve teaching and learning. Therefore, it is required of every teacher to give feedback to pupils to enhance pupils" performance.

Feedback is a key aspect of formative assessment. Teachers gained feedback in variety of ways from their students and in return provide feedback to their students.

According to Ramaprasad (1983) feedback given as part of formative assessment puts learners in the position to identify any loophole that exists between their desired learning outcome and their present knowledge, understanding or skill. Yet the teachers indicated that they only marked what pupils wrote and the pupils books were returned to them either on the same day or later. When pupils are given feedback that is helpful they are encouraged and are able to focus their attention thoughtfully on their tasks rather than getting the correct answers. That is, specific comments about their errors and specific suggestions for improvement enable students to monitor their progress. Thus assessment can be considered formative only if the feedback is used to improve teaching and students‟ learning (Black, 1996). Feedback supplied by the teacher or as self- assessment by the student is intended to improve the students‟ learning and places the learner in the central role of the learning process (Brookhart, 2011).

The findings on feedback indicated that about 57.3% of the teachers gave both oral and written feedback to pupil and the rest gave oral or written feedback depending on the mistakes made. The teachers indicated that pupils normally reacted to negative feedback but accepted positive feedback. Feedback to students reinforces successful learning and identifies the learning errors that need correction (Trowbridge, Bybee & Powell, 2004). Teachers are therefore requested to give feedback on the task performed to redirect the learners to make appropriate corrections for clear understanding of science concept.

The findings indicated that more than half (50.7%) of the teachers used assessment result for making judgment of learners performance while 12% of the teachers used the results to provide feedback to parent. But only 18.7% of the teachers indicated they use assessment result to improve learning. These results give clear indication that the majority of science teachers‟ main focus on assessment is assessment of learning but not assessment for learning. The only form of assessment that enhances performance is assessment for learning (Black, 1996). Therefore, teachers preferred use of assessment of learning may likely lead to poor performance. Black (1996) found that assessment for learning is one of the most powerful ways to improve learning, especially among students who find learning to be more challenging. By applying the principles and techniques of assessment for learning, students can be helped to learn better and achieve more in all areas of their educational experience.

In addition, assessment for learning is based upon an understanding of student motivation and the psychology of learning, so students become better learners for the rest of their lives as a result of their successful learning experiences.

CHAPTER SIX

SUMMARY, CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

6.1 Overview

This chapter summarises the study and report major findings. It highlights the conclusions of the study and implications for practice. The implications were based on the major findings identified in the study. It further outlines some recommendations and suggestions for further research.

6.2 Summary of the Study

The study investigated integrated science teachers‟ curriculum knowledge, classroom instructional and assessment practices in Effutu Municipality of the Central Region of Ghana. The study also solicited the teachers‟ background information and their integrated science curriculum knowledge as well as their practices of classroom instructional practices and assessment.

The 2012 integrated science curriculum placed much emphasis on acquisition of general scientific literacy by every Ghanaian citizen as a requirement for successful living in modern times (CRDD, 2012). The main focus of science is to understand the natural world. However, (UNESCO, 2010) contends that, teachers‟ who are the main implementers of curriculum are usually faced with problems of adjusting to curriculum especially in situations where many teachers at JHS level are teachers who don‟t have science background and teach additional subjects to science.

In order to understand integrated science teachers‟ curriculum knowledge, classroom instructional practices and assessment practices, the following objectives were considered:

1. investigate Effutu Municipal Junior High School integrated science teachers‟ knowledge on the integrated science curriculum
2. determine the relationship that exists between integrated science teachers‟ background factors and their content knowledge of the integrated science curriculum
3. determine Effutu Municipal Junior High School integrated science teachers‟ instructional practices in the science classrooms
4. examine Effutu Municipal Junior High School integrated science teachers‟ assessment practices in the science classrooms

The study adopted explanatory sequential mixed method design. Seventy-five integrated science teachers were involved in the study. Through observation, interview and questionnaire, data were collected on integrated science teachers‟ curriculum knowledge, classroom instructions and assessment practices. Quantitative data were analysed using descriptive statistics in the form of percentages and frequency and inferential statistics (Pearson Product-Moment Correlation) were used to analyse the data. In the qualitative phase, data were obtained from the interview and the observation and the responses were then organized into themes and analysed.

6.3 Key Findings

6.3.1 Research Question 1: What knowledge do Effutu Municipal Junior High School integrated science teachers have about the JHS science curriculum?

It was found in this study that majority of the teachers‟ knowledge of the integrated science curriculum was low because majority of them did not have any form of in service training which would have helped them acquire or deepen their knowledge about the subject matter content, pedagogy, and assessment methods required to implement the integrated science curriculum. Aside their lack of the appropriate science curriculum knowledge they failed to demonstrate the competencies required in classroom science instruction.

6.3.2 Research Question 2: What relationship exists between integrated science teachers‟ background factors and their content knowledge of the integrated science curriculum?

The Pearson Product Moment Correlation suggests only professional qualification had a slight positive correlation with integrated science teachers‟ content knowledge of the integrated science curriculum. The correlation between JHS teachers‟ professional qualification and content knowledge of the integrated science curriculum is lesser than 0.05 which means there is statistically significant relationship between the content knowledge of teachers and their professional qualification.

6.3.3 Research Question 3: What instructional practices do Effutu Municipal Junior High School integrated science teachers‟ use in their classrooms?

Results from the observational guide showed that majority of integrated science teachers in the Effutu Municipality of the Central Region generally adopted child-centred teaching practices at the introduction and evaluation stage of the lesson. However, the teachers used teacher-centred instructional strategies for presentation of lessons.

6.3.4 Research Question 4: What assessment practices do Junior High School science teachers use in the classrooms?

It was found that the majority of the Junior High School science teachers were interested in summative assessment than that of the formative assessment. This is because most teachers preferred assessing their pupils at the conclusion stage of instruction, at the end of a topic, end of month and end of term. Only few of the teachers assessed the pupils before, during and after instruction. Also most teachers preferred given written feedback instead of engaging the pupils in one – on – one discussion on the task perform to make appropriate corrections to improve performance. The finding also indicated that the science teachers still practiced the old continuous assessment instead of school base assessment (SBA) recommended in the science curriculum.

6.4 Conclusions and Implication

This study represents an initial effort to provide documentation on the Junior High School science teachers" curriculum knowledge, instruction and assessment practices. Using both quantitative and qualitative approaches, this study provided research based understanding of certain strengths and weaknesses of the current practices of Ghanaian Junior High Schools science teachers" science teaching and assessment.

The findings put the need of assigning teachers who have adequate science content knowledge to handle integrated science in Ghanaian junior high school. These will create new ways and opportunities for the development of pedagogical thinking in the domain of science among teachers.

The knowledge about integrated science curriculum and materials will enable the Junior High School science teacher to use alternative ways of representing science concepts to make them understandable to learners. Some of these alternative representations include analogies, illustration, examples, explanations and demonstration.

Also science teachers are to study the school base assessment properly and practice them effectively in their classrooms to improve performance. The study also revealed that teachers gave feedback to students; this feedback both oral and written was centred on praising students. The results of students‟ assessment were used by teachers to make judgment and improve teaching. Teachers also discussed assessment results with students and parents for them to know their performance. Appropriate feedback in assessment is the proper tool to improve performance. Therefore teachers‟ should spend time to discuss learners‟ assessment task results with the pupils in order to give proper oral and written feedback which would be accepted by the pupils to make proper amends.

Although further research is needed to elaborate and substantiate the findings of this study, it provides initial evidence of science teachers‟ curriculum knowledge, instructional and assessment practices in Ghanaian Junior High School science classrooms.

6.5 Recommendations

Based on the findings, the researcher recommends the following:

1. The findings of the study have suggested that teachers with more science curriculum content knowledge are more likely to teach in ways that help students construct knowledge. It was also evident that majority of the teachers were not trained science teachers and so lacked both science content knowledge and pedagogical content knowledge required for proper science instruction and assessment. The schools and the Municipal Directorate of Ghana Education Service should organise periodic in-service training programmes to upgrade or improve JHS science teachers" curriculum and pedagogical content knowledge to enable them use science teaching strategies recommended for teaching of science at the basic school level.
2. The Headteachers, Circuit Supervisors and the Municipal Science Coordinators should ensure that JHS science teachers move away completely from teacher centred to the science inquiry based child - centred teaching methods. Teachers should be encourage to use teaching and learning materials in their class to ensure pupils participation.
3. Municipal educational directorate should not measure the teachers output of work only on number of exercises teachers prepare in a term, rather focus mainly on what the pupils would be able to achieve at the end of a lesson through proper SBA which covers both formative and summative assessment. Teachers should be encouraged to assist their pupils to do at least one project as recommended in the teaching syllabus.

6.6 Suggestions for Further Research

The findings of this study call for further research in the area of teachers" curriculum knowledge, classroom instruction and assessment practices. The following are recommended for further research:

The findings of the study cannot be generalized because they do not represent a regional picture of the Junior High Schools science teachers" curriculum knowledge and instructional practices in the Central Region of Ghana. So there is the need to replicate the study in other District/Municipality in the Region to provide a regional data on science teachers" curriculum knowledge and instructional practices. This will contribute immensely to future national research of science teaching and professional development of science teachers towards science instruction and assessment.

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APPENDIX A

Questionnaire for Measuring Junior High School Integrated Science Teachers' Curriculum Knowledge (ISTCK) and Assessment Practices

Introduction

Dear Colleague, thanks for agreeing to participate in this study. The purpose of the study is to find out Junior high school integrated science teachers curriculum knowledge and their assessment practices. It is hoped that the information you provide will inform the stakeholders, teachers, GES Effutu municipality and the curriculum developers. Thank you.

Instruction

Please read the following statements and kindly provide the information required. The first part seeks background information about you while the second part requires your honest opinion on science curriculum knowledge. In most cases you will be required to select the option that best describes your approach to the teaching and assessment of integrated science in the Junior High school at the last part.

Your identity will not be disclosed in the report. That is why you do not provide your name. Whatever information you will provide will remain anonymous and it will not in any way affect your status as integrated science teacher

Part I
Background Information

Kindly provide the following information either by writing or ticking at the appropriate place.

1. Name of circuit a. East [ ] b. Central[ ] c. West[ ]
2. Indicate where you teach a. Public [ ] b. Private[ ]
3. Sex: a. Male [ ] b. Female [ ]
4. Academic qualification:

   a. G.C. E Ordinary level [ ] b. G.C.E. Advance level [ ] c. SSSCE/WASCE [ ]

   d. Diploma Basic Education [ ] e. Bed. Basic Education [ ] f. HND [ ]

   g. Bed. Science degree [ ] h. others (specify)...................................
5. Professional qualification(s):

a. Cert „A" 4-year [ ] b. Cert „A" Post Sec [ ] c. Diploma (Basic Education) [ ]

d. Diploma in Education [ ] e. B.Ed. Basic education [ ] specialization ....

6. Number of years of teaching experience:

   0 - 3years [ ] 4 – 6years [ ] 7-10years [ ] more than 10 years [ ]

7. Junior high classes taught

a. JHS 1 [ ] b. JHS 2 [ ] c. JHS 3 [ ] d. JHS1& 2 [ ]

e. JHS 2&3 [ ] f. JHS 1&3 [ ] JHS1, 2&3 [ ]

PART II

This questionnaire is designed to elicit your honest view on science teachers" curriculum knowledge. Please kindly give the best responses you can. You are to answer the questions and give reasons where necessary. Tick [√] for the answer chosen. Thank you.

Section A: Teachers' Knowledge of Science Curriculum Materials

8. Do you have science curriculum materials in your school?

   Yes [ ] No [ ]

   (If YES, go to 9)

9. Which of these Science curriculum materials do you have in your school? (Tick as many as are applicable)

   a. Syllabus [ ] b. Teachers" Guide [ ] c. Pupils textbook [ ]

   d. Charts/Pictures [ ] e. other materials [ ] f. none [ ]

10. Do you use science curriculum material in science lesson preparation and delivery

    Yes [ ] No [ ]

11. If Yes, how often do you use them?

a. Sometimes [ ]   b. Often [ ]   c. More often [ ]   d. Always [ ]

12. Do all the topics in the other science curriculum (textbooks and Teachers Guide) material correspond with the ones in the syllabus?

a. Yes [ ]   b. No [ ]   c. Not Sure [ ]

13. Are the teaching and learning activities in the other curriculum material correspond with the ones stated in the syllabus?

a. YES [ ]   b. NO [ ]   c. NOT SURE [ ]

SECTION B:

Integrated science teachers' knowledge about the organization of the syllabus

14. What is the rational for teaching science in Junior high school?

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15. The content of the science syllabus are grouped into how many themes? (circle one of them)

a. 3   b. 4   c. 5   d. 6   e. 7 or more

16. Name the themes.

....

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....

17. How many periods are stated in the syllabus for the teaching of science in the science classroom within a week?

a. 3 b. 4 c. 6 d. 8 e. 10

18. Out of the number of periods chosen how many of them is/are allocated for the teaching of ;

a. Theory ....

b. Practical ....

19. a. What are the weights of the profile dimension for teaching, learning and testing in Integrated Science at JHS. (thick under the correct weight)

	20%	30%	40%	50%	60%
Knowledge and Comprehension					
Application of Knowledge					
Experimental and Process Skills					

b. How do the specific dimensions influence your teaching of integrated science?

....

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....

20. What type of instructional/teaching approach is recommended in the Junior high school science syllabus?

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21. What form of assessment is recommended in junior high school science syllabus?

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SECTION C

Integrated Science teachers content knowledge of science curriculum.

22. Group the following JHS 1 topics under the various sections indicated in the table below: Introduction to Integrated Science, Vegetable Crop Production, air pollution, Matter, Life Cycle of Flowering Plants, Measurement, physical and chemical changes, farming system, Conversion and conservation of Energy, Basic Electronics, Light Energy, Nature of Soil, Sources of Energy, Ecosystems, Hazards, Respiratory System of humans

Sections	Topics
Introduction to science	
Diversity of matter	
Cycles	
Systems	
Energy	
Interactions of matter	

23. Which of the topics do you find difficult to teach?

....

....

....

24. Can you give any reason?

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25. Which of these topics do you teach with ease?

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26. Can you give any reason?

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27. Group the following JHS 2 topics under the sections in the table below:

Elements, Compounds and Mixtures, Reproduction in Humans, Heredity, Diffusion and Osmosis, Circulatory System in Humans, Photosynthesis, Food and Nutrition, Infections diseases of humans and plant, Pests and Parasites, Force and Pressure, Machines, Electrical Energy, Basic Electronics, Metals and Non-metals, Carbon Cycle, Mixtures, Chemical Compounds, Water, Weather, Season and Climate

Sections	**Topics**
Diversity of matter	
Cycles	
Systems	
Energy	
Interactions of matter	

28. Which of the topics do you find difficult to teach?

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29. Can you give any reason?

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30. Which of these topics do you teach with ease?

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31. Can you give any reason?

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32. Group the following JHS 3 topics under the sections indicated in the table below: Acids and Bases, Heat Energy, Basic Electronics, Magnetism, Digestion in humans, Life Cycle of a Mosquito, Soil and Water Conservation, The Solar System, Dentition in Humans, science related industries.

Sections	**Topics**
Diversity of matter	
Cycles	
Systems	
Energy	
Interaction with matter	

33. Which of the topics do you find difficult to teach?

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34. Can you give any reason?

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35. Which of these topics do you teach with ease?

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36. Can you give any reason?

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PART III

This questionnaire is designed to elicit your honest view on assessment practices in the science classroom as stated in science curriculum. Please kindly give the best responses you can. You are to answer the questions and give reasons where necessary. Tick [√] for the answer chosen. Your responses will be treated in confidential and will be used only for research purposes. Your identity is not required; hence your objectivity and truthfulness are highly counted upon for the needed outcome. Thank you.

Section A: How Teachers Organize their Classroom Assessment

37. When in the term do you organize assessment?

Start of the term [ ] Weekly [ ] Monthly [ ] Midway through the term [ ]

38. At what stage of instruction do you assess your pupils?

Introductory stage [ ] presentation stage [ ] Concluding stage [ ]

Throughout the lesson [ ]

39. At what point do you assess your pupils?

At the end of the topic [ ] At the end of unit [ ]

At the end of lesson [ ] At the end of the term [ ]

40. On the average how many assessment tasks do you give pupils in a term?

a. 0 – 10 [ ]   b. 11 – 20 [ ]

c. 21 – 30 [ ]   d. 31 – 40 [ ]   e. 40 and above [ ]

41. When do you design your assessment tasks?

During lesson preparation [ ]   During instruction [ ]

After instruction [ ]

42. What informs you of the type of assessment tasks you design in (5) above?

a. Content of the topic [ ]   b. Pupils knowledge level [ ]

c. objectives of the lesson [ ]   d. profile dimensions [ ]

e. evaluation questions in the syllabus [ ]   f. Others………

SECTION B

Type of tasks science teachers give to their students

43. What type of assessments do you give to your students?

(Tick more than one if applicable)

a. Class test [ ]   b. Homework [ ]   c. Project work [ ]

d. Class exercise [ ]   e. End of term test [ ]

44. How often do you give each of the assessments you have ticked in (a - e)?
(State number of times in a term)

a. Class test……………   b. Homework………………

c. Project work…………………..

d. class exercise………………..   e. End of term test………………………..

45. What profile dimensions are mentioned in the junior high School integrated science syllabus?

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46. Which of the profile dimensions do you examine mostly during school based assessment?

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47. Explain why you examine the above mentioned profile dimensions?

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48. How much time do you give your pupils to complete class exercise?

a. 5 – 10 mins [ ]   b. 11 – 15 mins [ ]   c. 16 – 20 mins [ ]

d. 21 – 25 mins [ ]   e. 36 – 30 mins [ ]   f. above 30 mins [ ]

SECTION C

Type of feedback science teachers give on the task of their pupils

49. What type of feedback do you give to your pupils after marking their exercises?

Oral feedback [ ]   Written feedback [ ]

Both oral and Written feedback [ ]

50. How do pupils react to the feedback you give them?

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51. What do your feedback to your students centre on? (Do they consist of statements praising the pupils or they have statements concerning the tasks)

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52. Give two examples of feedback centred on task.

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53. Give an example of feedback centred on pupils

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54. Please tick under the option that appropriately express your opinion on each statement in the table.

ITEMS	**OPTIONS**			
	Always	Very often	Sometimes	Rarely
I mark pupils" assignments during instruction as they work				
I allowed pupils to complete their assignment and submit later				
I mark pupils" assignment and return their marked books the same day				
I mark pupils" assignment and give it to them during the next lesson				
At the end of their assignment I ask pupils to exchange and mark their own exercise during class as I go round to				

supervise them				
How do they respond to feedback you give to pupils				
How often do you discuss tasks with your pupils after marking				

SECTION D

Science teachers use of pupils' assessment results?

55. What do you use your pupils"results for?
    To make judgment [ ] To give feedback to students [ ] To improve teaching [ ] To give feedback to parents [ ]

56. Why are parents interested in their pupils"assessment result?
    ……………………………………………………………………………………
    ……………………………………………………………………………………
    ……………………………………………………………………………………
    ………………………………………………………………………

APPENDIX B

OBSERVATION SCHEDULE FOR JUNIOR HIGH SCHOOL SCIENCE TEACHERS CLASSROOM INSTRUCTIONAL PRACTICES

	Inquiry stages	**Teachers Behavior**	**Frequency of episode**	**Percentage score**
Introduction	Engage / elicit	1. State the purpose and expectations for learning 2. Creates curiosity and gets student attention 3. Raise appropriate questions 4. Elicits responses that uncover prior knowledge 5. Identified and records student thinking 6. Create the opportunity for pupils to question		
Activities	Explore	7. Encourage pupils to work together 8. Provide common experiences 9. Observes and listens as student raise question 10. Asks probing question to redirect students 11. Provide time for students to puzzle through problems 13. divide the class for small group work		
	Explanation	13. Adds to the collective memory by recording ideas 14. Encourage pupils to explain in		

		their own words 15. Asks for justification and clarification from pupils 16. Directs lesson by formally providing definitions 17. Uses audio-visual or electronic resources 18. Uses student previous experiences 19. Encourages pupil to pupil interaction 20. Using classroom norms and discussion etiquette		
	Expand/ elaborate	21. Waite time after asking questions 22. Questions that challenge another thinking 23. Questions that justifies 24. Questions that allow pupils to change their mind 25. Encourage pupils to use formal labels 26. Encourage pupils to apply or extend concept 27. Remind pupils of alternative explanations 28. Refer pupils to existing data and evidence		
Evaluation	Evaluate	29. Observe pupils as they apply		

		new concepts 30. Compare ideas 31. Uses different assessment techniques 32. Allow pupils to assess their own learning 33. Ask opened ended questions 34. Evaluate collective memory of the class 35. Bring closure to the lesson		

APPENDIX C

INTERVIEW GUIDE FOR INTEGRATED SCIENCE TEACHERS' CURRICULUM KNOWLEDGE AND CLASSROOM INSTRUCTIONAL PRACTICES

PART I

Bio data:

1. Name of circuit
2. Where are you teaching (Public/Private)
3. Sex:
4. Academic qualification:
5. Professional qualification:
6. Classes taught:
7. Years of teaching:

PART II

1. What is the rational for teaching science in the JHS?
2. How does it help in your teaching and assessment?
3. Do you have curriculum materials in your school?
4. How do teachers who do not have curriculum materials prepare their lessons?
5. Why do you think some teachers who have curriculum materials wouldn‟t use it in their lesson preparation and presentation?
6. What type of instructional/teaching approach is recommended in the Junior High school science syllabus
7. Tell me about the SBA
8. Do you think the SBA guidelines are helpful to you as a teacher?
9. Which topics do you find difficult to teach?
10. Please give reasons
11. Which topics do you teach with ease? Please give reasons
12. Do you feel confident about science teaching?
13. Given the opportunity, will you continue teaching integrated science?
14. If YES, why? And if NO, why?
15. What do you think should be done to improve the teaching of integrated science?

16. What do you think GES should add or take from the integrated science syllabus?
17. What should be done to improve the integrated science syllabus?

APPENDIX D

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF EDUCATIONAL STUDIES
DEPARTMENT OF BASIC EDUCATION
P. O. Box 25, Winneba, Ghana
beducation@uew.edu.gh
+233 (050) 9212015

Date: April 30, 2019

The Municipal Director
Effutu Education Directorate
P. O. Box 54
Winneba

Dear Madam,

LETTER OF INTRODUCTION

We forward to you, a letter from Mr. Elisha Acquah Boakye, a second year M.Phil student of the Department of Basic Education, University of Education, Winneba, with registration number 81700300002.

Mr. Elisha Acquah Boakye is to carry out a research on the Topic *"Junior High School Integrated Science Teachers' Curriculum Knowledge and Instructional Approaches in the Effutu Municipality"*.

We would be grateful if permission is granted him to carry out his studies in the Municipality.

Thank you.

Yours faithfully,

....

MRS. SAKINA ACQUAH (PHD)
(Ag. Head of Department)

www.uew.edu.gh

APPENDIX E

GHANA EDUCATION SERVICE

In case of reply the number and Date of this letter should be quoted

REPUBLIC OF GHANA

MUNICIPAL EDUCATION OFFICE
POST OFFICE BOX 54
WINNEBA
TEL: 03323 22075
Email: geseffutu@gmail.com

My Ref. NO:GES/CR/EMEOW/PG.181^/VOL.6/68
Your Ref. No:.....................................

DATE: 9TH JULY, 2019

PERMISSION TO CONDUCT A RESEARCH

We acknowledge receipt of your letter dated 10th June, 2019 seeking permission to conduct a research in the Effutu Municipality.

Permission has been granted to Mr. Elisha Acquah Boakye, a second year MPhil student of the Department of Basic Education, University of Education, Winneba to conduct a research in the basic schools within the Effutu Municipality from 10th July to 31st July, 2019.

He is working on the research topic: "Public and Private Junior High School Integrated Science Teachers' curriculum knowledge and Classroom Instructional Practices in the Effutu Municipality".

Teachers are to assist him in gathering the necessary data for the research while also ensuring that he abides by the ethics of the teaching profession.

ROSE TENKORANG
MUNICIPAL DIRECTOR OF EDUCATION
EFFUTU-WINNEBA

MR. ELISHA ACQUAH BOAKYE
DEPARTMENT OF BASIC EDUCATION
WINNEBA

THE ACTING HEAD OF DEPARTMENT
DEPARTMENT OF BASIC EDUCATION
WINNEBA

ALL HEADTEACHERS OF BASIC SCHOOL
EFFUTU MUNICIPAL
WINNEBA

Copy to:- All Circuit Supervisors

GCMRS