UNIVERSITY OF EDUCATION, WINNEBA

PHYSICS TEACHERS' CLASSROOM PRACTICES AND STUDENTS' PERCEPTION OF THEIR TEACHERS' CLASSROOM PRACTICES

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DECLARATION

STUDENT'S DECLARATION

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

Signature:…….....…….

Date:…….....

SUPERVISOR'S DECLARATION

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

Mawuadem Koku Amedeker (Supervisor)

Signature:…….....……..

Date:…….....….

DEDICATION

I dedicate this work to my dear family (the Dah and the Deh Family of Hohoe-Fodome Amele)

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ABSTRACT

The purpose of the study was to investigate the activities and practices of physics teachers in terms of their pedagogical skills, assessment techniques used and students' perception of their physics teachers' classroom practices. The study was limited to physics teachers and students in eight (8) senior high schools in the Hohoe Municipality. Descriptive cross-sectional survey design was employed in carrying out the study. A total sample of 200 senior high school Physics students and 2 physics teachers were involved in data collection. A questionnaire consisting mainly of closed ended items, observation schedule and interview guide were used in collecting data from respondents. Data collected was analysed using simple frequencies, percentages, mean and standard deviation. It was found that, most of the physics teachers do not often respond appropriately to students' wrong answers and misconceptions. Most physics students also raised concerns about their physics teachers' not often linking what they teach to their daily life occurrences. However, evidence from observation indicates that physics teachers possess and exhibited sufficient knowledge on diverse pedagogical skills. Physics teachers often use interactive formative assessments such as oral question and answer technique. Also, physics teachers do not often motivate students and make them appreciate the fact that the things they learn in physics are important. Based on the findings, it was recommended that, physics teachers should carefully pay attention to and often address their students' wrong answers and misconceptions, make learning of physics interesting by making students appreciate the importance of what they teach, often encourage students to study physics and also show interest in the overall success of their students.

CHAPTER ONE

INTRODUCTION

1.0 Overview

In this chapter is presented issues that prompted the study and the purpose of the study. The chapter details the objectives as seeking to determine some of the classroom practices of physics teachers and how their students perceive the practices. Three research questions were derived from the objectives of the study and used to explore the types of practices senior high school teachers exhibit in their lessons and how their students perceive the practices. Further, the inherent and external problems that may serve as obstacles to the easy operation of the research have been treated under delimitations and limitations, respectively and possible solutions suggested in advance of preparing the research instruments. The entire work is organised in six chapters followed by the appendices that are attachments containing the research instruments and samples of answered research instruments.

1.1 Background to the Study

Physics is the most basic and fundamental natural science which involves universal laws and the study of the behaviour and relationships among a wide range of important physical phenomenon (Cutnell & Johnson, 2007). According to Onah and Ugwu (2010), Physics is considered as consisting of scientific facts, principles, laws and generalizations derived from scientific investigations. The principles and applications of physics cut across the various spectrum of everyday activities like walking, lifting objects, seeing, taking photographs using electrical and electronic gadgets among others (CRDD, 2010). Despite the numerous significant roles physics plays in the development of every nation, physics as a subject in the Senior High School still remains one of the subjects perceived by students as difficult as a result of

collection of equations used in solving problems which demands a firm grasp of the concept and the ability to reason. Physics is the most utilized basic science subject in most technology and technology related-profession but unfortunately it is a subject which most students especially girls fear to pursue (Murphy & Whitelegg, 2006). One of the values of studying physics is that it is intrinsically challenging and therefore also extremely rewarding when a student understands it.

Ayeni (2011) defines teaching as a process that involves bringing about desirable changes in learners so as to achieve specific outcomes. To teach is to show somebody how to do something so that they will be able to do it themselves. Loughran (2006) writes that: Teaching and learning are seen as being related in powerful and important ways such that teaching purposively influences learning and vice versa. The primary purpose of teaching at any level of education is to bring a fundamental change in the learner (Tebabal & Kahssay, 2011). To effectively help bring about this desirable change, teachers apply in the classroom, appropriate teaching methods that best suite specific objectives.

Teachers play important roles in the process of teaching and learning of all subjects including physics. They are mediators between the curriculum and the students who are recipients of the curriculum (Davis & Insaidoo, 2017). Teacher quality therefore has consequences for students' learning outcomes. One of the principal activities that take place in the classroom is learning which is effectively facilitated by the teacher. The concept of classroom environment as applied to the educational settings is viewed as a place where learners and teachers interact with each other and use a variety of tools and information in their pursuit of learning activities (Mucherah, 2008). The role of the teacher is very important in enhancing educational goals. If teachers are lacking in subject matter content and the appropriate

methodologies required for teaching, the quality of learning and performance will be poor (Onah & Ugwu, 2010). Teacher-students' relationship in and outside the classroom can greatly influence the interest and achievement of students in a particular subject.

Teachers' classroom practices are diverse and vary from teacher to teacher. In physics teaching, teachers are expected to take advantage of the various teaching processes in order to make full impact on their students' learning. It is clear that when students are pleased with the classroom practices of their physics teachers they are bound to give positive comments on their teachers' classroom practices (Ampadu, 2012). It is against this backdrop that classroom practices of physics teachers are worth investigating to find out what actually goes into the teaching and learning of physics in the classroom as well as explore the perceptions of physics students concerning their physics teachers' classroom practices.

1.2 Statement of the Problem

Physics is an essential component of Science education and one of the key components and purposes of science education should be to promote scientific literacy and equip the individual with the requisite skills necessary to become productive and useful in society (Dani, 2009; Millar, 2004). The vital position physics as a major branch of science occupies in today's society underscores the need to vividly ensure that effective teaching and learning goes on at the Senior High School level whilst more students are encouraged to study physics. Effective teaching and learning of physics is important to inspire the Senior High School students to a high level and mastery in science for their own benefit and the society as a whole (Millar, 2004). The interactions that take place in the classroom are meant to make

teachers succeed in their bid to facilitate the effective acquisition of knowledge by students (Borich, 2007; Fishburne & Hickson, 2001). It is believed that if genuine helpful interaction exists between the teacher and the students, the students will be able to inform teachers what they find difficult in physics, this will help reduce the difficulties they (students) encounter (Adeyemo, 2010) therefore resulting in improved academic performance.

However, findings from previous studies have indicated that the academic performance of Ghanaian students in physics in Senior High School has been generally and consistently poor over the years (Orleans, 2007). The problem of poor academic performance in science especially physics among Senior High Schools students is evident from the various reports released yearly by the West African Examination Councils' chief examiner. Common among these reports is the continuous emphasis on the weaknesses of the students which contributes to their failure. Most of the reports talk of the students as either performing averagely or worse compared to the previous years. The following are some of the reported weaknesses of students during the recent West Africa Secondary Schools Certificate Examination (WASSCE) by the chief examiner.

1. Incorrect definition of scientific terms;
2. Quoting inappropriate formula to solve mathematical problems;
3. Stating incorrect scientific laws.
4. Candidates generally exhibited lack of understanding and application of concepts principles and phenomena.
5. Many of the responses provided were poor, indicating that candidates did not treat many topics or did not revise adequately before taking the examination.
6. Some candidates lacked knowledge of some theories in Physics

7. Units were mixed up and calculations were not carried out in SI unit by some candidates.
8. Candidates have difficulty with calculations in mechanics and heat. (WAEC, 2011, 2013, 2018)

A study conducted by Langat (2018) found out that teachers' commitment, preparedness and challenges faced by Physics teachers which are some characteristics of their classroom practices were found to be influencing academic performance of Senior High School Physics students. Findings from a study in Sri Lanka reported by Tatto (2002) indicates that what the teacher does in the classroom is positively correlated with pupil achievement. Also, according to Bull et al. (2010), research concerning high school physics teachers' classroom activities, instructional methodologies has rarely been undertaken.

There is therefore the need to identify the major causes of the problem of poor academic performance among physics students at the senior high school level. It is against this backdrop that this study seeks to investigate the classroom practices of physics teachers, find out what actually goes into the teaching and learning of physics in the classroom as well as explore the perceptions of Physics students concerning their physics teachers' classroom practices. This action is in attempt to ascertain how the classroom practices of physics teachers contributes to students' perception and academic performance.

1.3 Purpose of the Study

The purpose of this study was to investigate the classroom practices of physics teachers and their students' impressions about their practices.

1.4 Research Objectives

The objectives of the study were to:

1. determine the pedagogical skills employed by senior high school physics teachers.
2. identify the types of assessments used by senior high school physics teachers in teaching physics.
3. determine the perceptions of physics students of their physics teachers' classroom practices.

1.5 Research Questions

The study sought to answer the following research questions:

1. What are the pedagogical skills employed by physics teachers in teaching at the senior high school level?
2. What types of assessments do physics teachers use in teaching physics at the senior high school level?
3. What are the perceptions of students of their physics teachers' classroom practices?

1.6 Significance of the Study

The findings from this study will enlighten stakeholders in education, especially those in the area of physics on what actually goes on in the physics classroom and how senior high school students perceive their physics teachers' classroom practices. This finding may serve as a catalyst for innovations in the teaching of physics, which will help enhance the teaching and learning of physics thereby increasing the number of students involved and willing to pursue physics at the tertiary level.

Physics teachers, school heads, administrators, parents and other stakeholders in education need information about what actually goes on in the classroom to enable them take important decisions such as supplementing these classrooms activities with others that will enhance effective teaching and learning when students are in and outsides the classroom.

The outcome and suggestions of this research will help potential teachers compare the content of the training they are provided with current practices and be provided with adequate information to enable them perform better when they become full time teachers.

The findings will also inform future policies and practices and identify significant areas for further studies. Additionally, the study will also be a good source of information and serve as a guide for those interested in carrying out further studies on related topics.

1.7 Delimitations

The study was confined to senior high schools in the Hohoe Municipality offering science programmes. This research also involved general science students who have spent at least a year in school which include only second and third year science students studying physics as their elective subject. Only science teachers who taught elective physics were involved in the study.

1.8 Organisation of the Study

The entire work is organised into six chapters. Chapter Two dealt with the review of relevant related literature based on the research questions outlined in the study. It also presented the theoretical and conceptual framework underpinning the study.

Chapter Three was centred on the methodology of the study. It described the research design, study area, population, sample and sampling techniques, data sources, research instrument, pre-testing, data collection procedure, ethical procedures and data management and analysis.

In Chapter Four entail a presentation of results of the study whiles in Chapter Five is a discussion of the findings of the study. Lastly, Chapter Six, the final chapter of the study, gave the summary of the study and drew conclusions on the key findings of the study. It outlined recommendations and suggestions based on findings of the study. The project chapters were logically arranged to provide insight into the issues raised in the chapters.

CHAPTER TWO

LITERATURE REVIEW

2.0.0 Overview

The purpose of this study is to investigate the activities and practices of physics teachers in terms of their Pedagogical skills, types of assessment they use in the physics classroom and students' perception of their physics teachers' classroom practices. The Literature review is divided into two main headings namely, empirical review and conceptual review.

Empirical review comprises a survey of related and relevant studies carried out on caption under the following headings:

i. Physics teachers' pedagogical skills,
ii. Technology (ICTs) as a teaching and learning resource
iii. Effect of the use of instructional materials in the classroom on students' academic achievement
iv. Types of assessment
v. Students' perception of their teachers' classroom practices.
vi. Empirical evidence of the use of formative assessment by teachers
vii. The role of the teacher in students' motivation
viii. Motivation and students' achievement

The following concepts which relates to the problem under investigation were reviewed

i. Pedagogical skills
ii. Pedagogical Content Knowledge (PCK)
iii. Technological Pedagogical Content Knowledge (TPACK)
iv. Classroom assessment

v. Teaching and learning resources

vi. Motivation of students

vii. Students' perception

Out of the concepts reviewed, the conceptual framework for the study was designed and explained.

2.1.0 Empirical Review

2.1.1 Pedagogical skills employed in the teaching of physics

Learning depends heavily on the pedagogical approaches teachers use in the classroom. A variety of pedagogical approaches exist, but some of them are more effective and suitable than others. The effectiveness of pedagogy often depends on the particular subject matter to be taught, the diverse needs of different learners, on-the-ground conditions in the classroom as well as the surrounding context. In general, effective teachers believe in the capacity of their students to learn, and carefully utilize a range of pedagogical approaches to ensure this learning occurs. (UNESCO learning portal, 2020)

The apparent drop in student interest in science and its related disciplines has been associated with the widely used traditional teaching approaches that are reinforced by teacher centred, transmissive pedagogy (Lyons, 2006). Findings from various literature indicates that many physics teachers continue to teach using the same old, ineffective, traditional, teacher-centred instructional approach (Angell, Guttersrud, Henriksen, & Isnes, 2004; Hackling, Goodrum, & Rennie, 2001; Vosniadou, 2007). The existence and practice of traditional approaches to teaching physics, often fail to promote adequate student understanding of physics concepts (Angell et al., 2004; Hackling et al., 2001; Masika, 2011; Mulhall & Gunstone, 2008, 2012).

Unfortunately, majority of physics teachers are products of traditional teaching methodologies and may have developed beliefs that are consistent with the kinds of implicit messages about physics and learning physics described above. A review of various studies on teaching pedagogies employed in the classroom and its impact on students learning and academic is discussed in this study.

Buabeng, Ossei-Anto and Ampiah (2014) examined the activities that go on in physics classrooms in senior high schools in Ghana by investigating the pattern of interaction and instructional methods used for teaching physics and level of coverage of physics syllabus. Twenty-one physics teachers and 326 physics students in public SHS in Ashanti Region of Ghana were sampled for the study. The survey design was employed for the study in which a questionnaire was used for data collection. The outcome of the study revealed that classroom interactions seemed to be mostly teacher-centred and did not seem to support inquiry-based teaching and learning which is noted for promoting conceptual change and boost performance. The researchers suggested physics teachers should be exposed to efficient pedagogies of teaching and presenting information to learners. McDermott (2001) suggests that the focus of physics teaching should be on the students as learners. It was also suggested in the study that effective teaching should include close contact with students where teachers observed the struggles of students as they tried to understand important concepts and principles. A similar situation was reported in High Schools in Norway. Angell et al. (2004) administered questionnaires to 2,192 Senior High School physics students and 342 Senior High School physics teachers in Norway. This was followed by interviews. The outcome of the study revealed that, greater fraction of time in the physics classroom (about 60%), was spent with the teacher presenting new material on the blackboard/whiteboard. Physics classrooms were dominated by “chalk and talk

instruction." Consistent with the above findings is that of a study carried out in Kenya where physics teachers were found to be autocratic and dominated their classrooms by talking only and sometimes talking with illustrations (Masika, 2011).

An examination of students' experience by Buabeng (2015) in relation to what actually happens in their classroom with regards to the teaching approaches and how often they would prefer the strategies to be applied revealed that students were relatively not satisfied with many of the instructions they received. The research findings indicated that generally, physics classroom dialogue tended not to support constructivist epistemology or inquiry based teaching and learning. Student-centred instructional approaches were not common in many physics classes. The researcher concluded that a focus on content knowledge and more 'traditional' teaching approaches tends to discourage students' progress. It is obvious that one of the most important factors that significantly affect students' achievement is the instructional strategy adopted by the teacher (Okoronka & Wada, 2014).

Azure (2015) examined senior high school students' perceptions of the teaching of Integrated Science in Ghana using a descriptive survey design. The study revealed that students are made to read textbooks while teachers explain some of the concepts. Whilst the curriculum suggests that students carry out project work for assessment, teachers teach without performing activities suggested in the curriculum. Also about, 70% of the rural students in the study indicated that they never carried out practical activities during Integrated Science lessons, while about 43% of the urban students indicated they never had the opportunity to do practical activities. McDermott and Shaffer (2000) and Blanton (2003) observed that teachers of science often taught in the way they had been taught. If they were taught through lectures, they were likely to lecture, even if this type of instruction was inappropriate for their

students. The findings in their study is an indication of the absence of teaching methods that give students the opportunity to observe, engage in, invent and discover knowledge as defined by the cognitive apprenticeship model.

It may be inferred from recent studies that teacher-centred instruction continues to be a widely used instructional strategy in senior high school physics classrooms. This has resulted in the challenge of promoting pedagogical change so that physics teachers teach for better students' understanding and learning.

2.1.2 Technology (ICTs) as a teaching and learning resource

The abstract nature of Physics as a subject has necessitated the need to use instructional materials in facilitating students' learning of physics (Adeyemo, 2010). Oladejo, Olosunde, Ojebisi and Isola (2011) indicated that, the use of instructional materials is very crucial in enhancing mastery of physics concepts. Instructional materials are very important in teaching because students easily remember what they see and it lasts longer in their memory as compared to what they hear. Other studies have identified various ways through which excellence in physics could be achieved to include improved teachers' strategies and application of appropriate Instructional materials (Askhia, 2010). Therefore, if we are to encourage more students to study physics, we need to recognize the use of instructional aids as an influential factor which can improve students' interested in the study of physics (Aina, 2013)

The place of ICT in science education cannot be over emphasized considering its effectiveness in improving the quality of teaching and learning. The role of technology (ICTs) in the classroom has greatly evolved in the past decades. Nguyen, Williams and Nguyen (2012) listed LCD projector, Computer, Speakers and over-head Projector as some of the ICTs that can help ensure effective teaching occurs in the classroom. They further emphasized that, the teaching of certain complex

concepts can easily and effectively be taught and demonstrated with the aid of computers and projectors. Technology plays a primary role in learning physics in most classrooms today.

The Education Endowment Foundation (EEF) in their guidance on the use of digital technology in the article 'Using Digital Technology to Improve Learning', stated that 'to date, technology has been most effective when it is used to supplement or enhance teaching, rather than to replace it' (Stringer, Lewin & Coleman, 2019). Omodara and Adu (2014) examined the relevance of educational media and multimedia technology for effective service delivery in teaching and learning processes using relevant content analysis method. Empirical evidences revealed positive effects of educational media and multimedia technology on learning from computer and television technology programs. It was then recommended that, educational media and technology is invaluable in teaching and learning activities.

According to (Jarosievitz, 2016, 2017), multimedia such as audio, video files and simulation programs and its applications as well as the use of ICTs such as laptops, smart phones and tablets for different reasons like reading, finding relevant content on the Internet and also for performing real measurements in the laboratory can change students' attitude to science subjects, especially Physics. Jarosievitz recommends that if we want to let our students leave universities with an adequate knowledge and with applicable skills in physics, we should take advantage of the ICTs, multimedia and devices such as laptops, smart phones, tablets and apply them in teaching and learning (Jarosievitz, 2009, 2011, 2016)

Despite the crucial role ICTs play in science education to enhance teaching and learning, its availability and use in the 21st century classroom is still lacking. Asiedu-Addo, Apawu and Owusu-Ansah (2016) investigated the usage of ICT by in-

service mathematics educators in the teaching and learning of mathematics. The study employed descriptive survey design, purposeful and convenient sampling technique to obtain 48 participants. Results show that, despite the large number of mathematics educators (95.8%) that were aware of the integration of ICTs only 41.7% were incorporating ICTs into the teaching and learning of mathematics. Microsoft Suite (MS Excel, MS PowerPoint and MS Word) are the ICTs they often incorporate in their instructions.

A similar survey was done in New Zealand by Buabeng (2018) to investigate teaching approaches, teacher feedback and guidance, and ICT usage during physics teaching. The survey involved 104 physics teachers. Data were analysed using descriptive statistical and inferential statistics – MANOVA. Findings with regards to the use of ICT tools (e.g. computers, simulation, internet etc.) indicate that, ICTs were rarely used in teaching Physics. Consistent with this finding is one in a related research carried out earlier by the same researcher and others. In a similar study, teachers were asked about their use of ICTs such as PowerPoint presentation, simulations, internet, computers and phones in teaching Physics. It was confirmed that, ICT tools were rarely used to enhance teaching and learning of physics. Students who participated in the survey confirmed that ICT tools were seldom used in teaching and learning of physics (Buabeng, Conner, & Winter, 2015).

2.1.3 Effect of the use of instructional materials in the classroom on students' academic achievement

A study was conducted to examine the effect of using standardized and improvised instructional materials on Academic Achievement of Secondary School Physics Students in Oyo State, Nigeria using quasi-experimental of pre-test post-test non-randomized control group. Purposive sampling was used to obtain a sample of

three co-educational secondary schools. The study employed Achievement Test (PAT) to measure students' achievement and Teachers Instructional Guide (TIG) to train the teachers in the experimental groups before data was collected. Findings from the study revealed that, there is a significant difference in the achievement of students taught using standard instructional materials, those taught with improvised instructional material and those taught using without instructional materials. (Oladejo, Olosunde, Ojebisi, & Isola, 2011).

To further confirm the important role instructional materials, play in ensuring effective teaching and learning and the need to improvise when they are inadequate or not available, a study was carried out to determine the availability, uses and improvisation of instructional materials and the implications on teaching and learning of physics in secondary schools. The study involved 23 physics teachers and 39 physics students. With the help of descriptive survey method, 64-item questionnaire was used to gather data from both the teachers and students. Findings revealed shortage of instructional materials; inadequate use of the available ones and teachers' making use of local materials to improvise physics teaching instructional materials. (Aina, 2013). It was further revealed that the improvised materials had a positive influence on students' learning by improving students' learning.

Despite the insufficiency in the level of teaching and learning resources in the study area, it was reported that, there was a positive and significant correlation between most of the teaching and learning resources and level of classroom management and content delivery (Bizimana & Orodho, 2014)

In a similar studies conducted in Secondary Schools in Federal Capital Territory (FCT) Abuja, Nigeria, the extent of availability, application and impact of instructional aids on improving academic performance of physics students was

investigated. A total of 3,150 students and 163 teaching staff were sampled for the study. Findings also revealed shortfalls in availability of some instructional materials. Out of 176 respondents, 168 (95.45%) agreed that the physics teachers in Abuja make use of Instructional aids. The study reported improved academic performances among physics students taught with instructional aids. (Adebayo & Adigun, 2018)

Contrary to many reports of teachers not using instructional aids in teaching and to confirm it relevance, a recent survey conducted by Kettle (2020) to examine how videos are used in UK physics classrooms for the communication of physics ideas and for practical work, students were asked whether they enjoy watching videos as part of a lesson. 100% of a sample of 51 agreed. Teachers find watching online videos useful too. 53% of a sample of 51 teachers use videos to help review a topic before they teach it. 67% of a total of 52 survey respondents put links to relevant videos onto their school's moodle site or equivalent virtual learning environment. (Kettle, 2020).

This literature reviewed above brings to reality the need for physics teachers to be mindful of the impact of instructional materials in improving students' academic achievement. There is therefore the need for physics teachers to be creative in the selection, planning and application of instructional materials. Also, Physics teachers are encouraged to use improvised instructional materials because it is equally effective in promoting and enhancing teaching-learning process.

2.1.4 Types of assessment used by teachers

Mikre (2020) is of the opinion that in assessment of students' learning progress and competence attained, there is the need to gather a variety of information and determine the degree to which students have attained the learning targets intended in the curriculum. Information of this nature is gathered using a variety of techniques

such as formal and informal observation of students, paper-and-pen tests, laboratory work, performance on assignments, research projects and presentation. According to Airasian (2001), assessment includes the full range of information teachers gather in their classrooms which goes beyond just administering, scoring and grading paper-and-pen tests. The information obtained through assessment helps teachers to understand their students and monitor instruction.

This study reviews the various formal and informal forms of assessment employed by teachers in the classroom to ensure that enough information and feedback is obtained to determine the degree to which students have attained the learning targets intended in the curriculum. The literature has identified various formative assessment techniques that are commonly used in the Ghanaian senior high school classroom. (Plybour, 2015; Andrade & Cizek, 2010). Question and answer technique, Peer-assessment, self-assessment, Think-Pair-Share, class exercises, homework and class tests are some of the commonly used formative assessment strategies to identify students' strengths and weaknesses (Plybour, 2015; Andrade & Cizek, 2010). These assessment practices are deemed relevant and good types of assessment to be used in classroom assessments (Popham, 2002; Weeden et al., 2002). In Ghana, formative assessment is well embraced and practised by teachers at all levels of Education (Asare, 2015; Amoako, 2018).

2.1.4.1 Peer-assessment

Peer assessment provides learners with the opportunity to take responsibility for analysing, monitoring and evaluating aspects of both the learning process and product of their peers (Bekoe, Eshun & Bordoh, 2013). In peer-assessment, students often assess other students' work compared to the criteria developed by the instructor, or both students and the class instructor. An important aspect of peer assessment is

that it engages students in dialogue with their classmates, commenting on each other's work rather than a one-way feedback system from instructor to student. According to Black and Wiliam (2000) peer-assessment is an important component to self-assessment that helps to realise curricular targets for students' learning. Peer-assessment is also useful in placing the learning task in the hands of students thus making learning students-centred as proposed by the constructivist approach to learning. A study by Papinczak, Young and Groves (2007) revealed that peer-assessment enhanced students' willingness and ability to become active members of a group of learners. The findings of Eshun, Korwu and Appiah (2017) also confirmed the advantages associated with the use of peer-assessment in higher education instead of a teacher centred approach and reaffirmed the existing unequivocal views held by similar studies.

2.1.4.2 Self-assessment

Self-assessment is the act of a student to judge their own performance in order to take decisions about their academic abilities (Noonan & Duncan, 2005). Montgomery (2001) also provided a similar definition of self-assessment as students' appraisal of their own work or learning developments Herrera, Murry and Cabral (2007) are of the opinion that self-assessment is a valuable tool for learning and measurement. According to Herrera et al. (2007), when students are engaged in assessing their own work, they try to learn the criteria for high-quality performance provided by the teacher and experience a willingness to apply those criteria. Black and Wiliam (2005) also argued that, self-assessment together with peer assessment help students develop an overview of the topic taught.

2.1.4.3 Think-pair-share

One other formative technique that allows discussion of feedback with peers is think-pair-share. Formative assessment techniques, such as concept checks, think-pair-share, and self-and peer-assessment, constitute active-engagement formative activities that may be said to be learner-centred and learning-centred. Several researchers have found that feedback between students facilitates concept learning. The think-pair-share technique allows individual thinking as well as peer discussion in class to arrive at answers (Plybour, 2015; Tyminski, Richardson & Winarski, 2010).

Previous studies found that students needed to monitor their progress by applying ongoing meaningful feedback that is helpful in showing them how to meet ultimate learning targets (Brookhart, 2001; Shepard, 2001; Stiggins, 2001). The arguments of several authors in science education suggest that an effective assessment for learning strategies depends, among other aspects, on active students' involvement, their ability to assess their colleagues and themselves (Harlen, 2006; Race et al., 2005). Black (2010) has also underscored the need to involve students in the assessment process as it is believed that the heart of the formative interaction is the active involvement of students.

In applying assessment techniques which ensures active involvement of students such as peer and self-assessment and think-pair-share, the teacher's role is to provides the criteria for assessment (scoring) and act as a guide in the assessment process (Gronlund & Cameron, 2004). Much emphasis laid by previous literature (Black, 2010; Brookhart, 2001; Harlen, 2006; Race et al., 2005; Shepard, 2001; Stiggins, 2001) highlighting the need to involve students in the formative assessment process greatly encourages learner-centred approach to teaching and learning in the classroom and supports constructivist approach to knowledge acquisition.

2.1.4.4 Class exercises, classroom tests and homework

Classroom exercises, tests and homework (assignments to be completed outside the classroom) are often commonly used by teachers to diagnose students' strengths and weaknesses, monitor each student's progress, determine teacher's own instructional effectiveness and help teachers to clarify their instructional intentions. Test advocates argue that regular classroom testing increases instructional effectiveness and inspires students to study more often. Frequent testing also provides opportunities for teachers to correct students' errors, to reward good performance, and to give students a good indication of what they were expected to learn. On the other hand, opponents of regular testing are of the view that frequent classroom testing could take away instructional time (Taale, 2012).

2.1.5 Empirical evidence of the use of formative assessment by teachers

In a study conducted by Plybour (2015), findings indicate that peer assessment was regularly used in formative mode at the beginning of lessons, especially during classroom discussion of homework. Teachers gave students the opportunity to grade and comment on a peer's work. However, about 62% of student respondents raised concerns about the quality of peer feedback and comments. The study concluded that the integration of formative assessment system into instructional design results in higher learning gains in physics than a conventional summative system. In a similar study, Akyina and Oduro-Okyireh (2019) investigated senior high school teachers' formative assessment practices in the Mampong Municipality of Ghana. Teachers were asked to indicate the extent to which they used formative assessment strategies in facilitating learning in their classrooms. It was revealed that teachers use question and answer technique, encourage students to do self and peer assessment during lessons in the classroom. The use of class exercises was more prominent among the

formative assessment techniques used. Similar to the findings Akyina and Oduro-Okyireh (2019) test, assignment, students' note and quiz were sampled as assessment methods often used by teachers of secondary schools in Osun State, Nigeria (Faleye & Adefisoye, 2016).

Another related study conducted with the primary purpose of describing assessment practices that secondary physical education teachers use in Ghana indicated that teachers used knowledge test, individual project and essay in their theory lessons as means of assessing their students. The deductive analysis indicated that about 81% of teachers reported knowledge test as the most frequently used assessment practice in their theory lessons. Most of the teachers in this study used assessment for documenting learning, rather than for accountability purposes (Sofo, Ocansey, Nabie, & Asola, 2013). Mintah (2017) in a similar study also found that, teacher observation, demonstration, peer observation, and checklist were the commonly used authentic assessment techniques among public school physical education teachers in Ghana. Anecdotal record and parental report were the least used techniques. It was further revealed through the study that, physical education teachers perceived authentic assessment as having positively enhanced students' motivation, self-concept, and skill achievement. Similarly, Amoako (2018) examined formative assessment procedures commonly used by Distance Education tutors in Ghana and found 'observation', 'oral questioning', 'peer-assessment', 'student self-assessment' and 'tutor made test' as the current formative assessment practices of on-site course tutors of Distance Education in Ghana. It was also found that majority of the tutors made use of multiple formative assessment procedures (Amoako, 2018).

On the contrary, a study was conducted in junior secondary schools in the Winneba Educational District to investigate the types of assessment used by teachers

specifically to assess the problems faced by science teachers in organising the continuous assessment. It was found that science teachers barely apply their knowledge of continuous assessment even though they appeared to have understood the philosophy of the continuous assessment (Amedeker, 2000). To ascertain the formative assessment techniques tutors use to assess teacher trainees' learning in social studies in colleges of education in Ghana, Bekoe, Eshun and Bordoh (2013) found out that due to the hasty nature in formulating formative assessment and scoring, tutors laid emphasis on cognitive domain to the neglect of affective and psychomotor domains. This make students go through the academic system without acquiring needed skills, values and attitudes that will enable them to right the wrong in society using appropriate tools. It was observed in a classroom setting that tutors asked questions in open discussion, use questions and answers to introduce their lesson and students were called to summarise what they learnt after the lesson. Tutors agreed that interactive formative assessments promoted learning outcomes through questioning in a form of dialogue (Bekoe, Eshun & Bordoh, 2013).

Literature (Akyina & Oduro-Okyireh, 2019; Amoako, 2018; Faleye & Adefisoye, 2016; Mintah, 2017) has revealed that teachers often observe, use tests and make room for self and peer assessment in order to gather vital information concerning students' academic progress. The use of classroom test is the commonly used technique. According to Akyina and Oduro-Okyireh (2019) classroom assessment has the benefit of providing immediate feedback to improve teaching and learning when it is used appropriately and effectively. Also, the feedback and comment provided during the assessment process are very important to strengthen self-efficacy and motivate students for learning (Mikre, 2020).

2.1.6 The role of the teacher in students' motivation

Teachers frequent interaction with students makes teachers occupy a very crucial role in helping students develop intrinsic and extrinsic motivation towards studies. A common opinion shared in a number of published reports is that, teachers are seen as the best motivators and teachers' characteristics are one of the vital influences on students' learning and motivation (American Association of Physics Teachers, 2009; Australian Institute for Teaching and School Leadership, 2011; Organisation for Economic Co-operation and Development, 2013). This brings to light the important roles teachers play in motivating students towards learning. To enable teachers effectively execute this crucial task, McKinney (2011) is of the view that teachers should create conducive learning environment that is challenging, stimulating and relevant to boost students' interest and motivation.

If teachers provide appropriate feedback to their students, arouse students' curiosity and attention, make them recognize and appreciate the importance of the content they teach and have students share their ideas in classroom discussions, it will go a long way to increase students' motivation as well as improve their academic achievement (Glynn & Koballa, 2006; Smith & Schmidt, 2012). Motivation is also very important for effective classroom management because it can enhance effective teaching and learning and hence result in high academic performance. (Wiseman & Hunt, 2008)

A study conducted by Korur and Eryilmaz (2018) to identify the process of interaction between students' motivation and characteristics of two physics teachers revealed that, teachers' characteristics like enthusiasm and giving examples from daily life improved students' motivation by increasing their attention and willingness to participate in classroom discussion. This report is in alignment with the findings of

Alkhayyatt (2000) which indicates that teachers' characteristics like enthusiasm, use of examples and ability to construct problem-solving strategies for physics problems increase students' motivation. A similar finding was reported by Fives (2003) and Opdenakker and Damme (2006) in their studies, it was confirmed that teachers' beliefs, perceptions, actions, attitudes and interests toward science teaching, teaching techniques and teaching behaviours in classroom practice are teachers' characteristics that affect students' motivation and learning. Demonstration of effective characteristics by teachers, create every opportunity for their students to be motivated (Brophy, 2010). Bayar and Kerns (2015), in a related study pointed out that Physics teachers' undesired behaviours and lack of enthusiasm to teach affect students' motivation negatively. Keller, Chang, Becker, Goetz and Frenzel (2014) also emphasized on the fact that, Physics teachers' characteristics or behaviours have an effect on students' motivation.

2.1.7 Motivation and students' achievement

It is evident from observations and supported by literature that most students taking physics courses from the onset have negative feelings towards the subject, as a result of the numerous notions by their colleagues which paints negative pictures of physics as being a very difficult subject (Lyons, 2006; Osborne, Simon, & Collins, 2003). Unfortunately, students who lack or have low motivation towards a subject tend to lack purpose and satisfaction and this low or lack of motivation contributes to their poor achievement (Brophy, 2010; Gagne & Deci, 2005).

Various studies attest to the fact that there are significant relationships between motivation and student achievement. This unveils the significant function motivation plays in student achievement (Richardson, Abraham & Bond, 2012; McKenzie and Schweitzer 2001; Sankaran & Bui 2001; Karagüven 2012; Kaya 2013;

Wolters & Rosenthal 2000; Yazıcı & Altun 2013). Orhan-Özen, (2017) studied the effect of motivation on student achievement using a meta-analysis design and found out there exist a positive relationship between motivation and student achievement. The effect size of motivation on student achievement was calculated as .27 which indicates a low level effect of motivation on student achievement.

Studies emphasizing the significance of motivation as an element that facilitates the learning achievements of the individuals have maintained that learning achievement and its effectiveness may differ according to motivators such as interest, desire and need. (Karagüven 2012; Kaya 2013; Wolters & Rosenthal 2000). This implies that, although there are studies showing that there is a positive relationship between intrinsic motivation and achievement (Burton, Lydon, D'Alessandro, & Koestner, 2006; Lepper, Corpus, & Iyengar, 2005) there are also studies suggesting that intrinsic and extrinsic motivation should be combined together in order to motivate an individual to get into action for a goal (Barrett, Plotnikoff, Raine, & Anderson, 2005; Gillet, Vallerand, & Rosnet, 2009; Hayenga & Corpus 2010).

In the quest to provide and develop in students the desire and motivation to enrol in and study certain subjects tagged as difficult such as physics, the role of the teacher cannot be neglected. Teacher characteristics, classroom management and other classroom activities can motivate or demotivate students towards the study of physics. Various studies have reported and confirmed the importance motivation plays in the teaching and learning process but it is unclear from recent studies the types or means of motivation provided by Senior High School physics teachers and if science students are motivated enough to pursue physics at the tertiary level. It is therefore crucial that, in a study of this nature which seeks to investigate the

classroom activities of physics teachers, the researcher finds out if physics teachers are making conscious efforts to motivate students and how.

2.1.8 Students' perceptions of their teachers' classroom practices

According to Ou (2017), perception is a process and consists of three stages namely, selection, organisation and interpretation. At the selection stage, one converts stimuli from the environment into meaningful experience. During the organisation stage, one finds certain meaningful patterns and organises their experiences by putting things or people into categories. We finally attach meaning to the selected stimuli at the Interpretation stage. Fundamental to perception is that there is an experiencing person (perceiver) secondly, something is being perceived (either an object, person, situation or relationship); thirdly, there is the context of the situation in which objects, events or persons are perceived and finally, there is the processing of nature of perception starting with the experiencing of multiple stimuli by the senses and ending with the formation of precepts.

From the researchers' (Ou, 2017) point of view, perception is an individual's interpretation of the information gathered through the senses about an object, person, situation or relationship. Specifically, students' perception of their teacher's classroom practices can be defined as students' interpretation of their teacher's actions or practices to ensure effective teaching and learning in the classroom. It is a common opinion held by students concerning the teaching and learning activities facilitated by their teacher in the classroom.

Students' individual experiences and opinions are partly shaped by the shared events in the classroom. Teachers should therefore not underestimate their teaching style, attitude and behaviour in class because most students express concern about their teachers' attitude, behaviour and other classroom activities (Ampadu, 2012).

Students usually assess teachers by their ability of communication, the methods of teaching and the contents of the subject they teach. Students expressing negative concern could go a long way to affect their attitude towards the teacher and the subject.

The perception of student toward the education process relatively impacts the decision of the students in the institution. Indirectly, the positive perception of students towards learning in the educational process will offer the benefit for higher academic success rate for the students (Gul, Ince & Turan, 2011). Research on students' perception has received much attention over the years as students' opinion are sought on many aspects of the teaching and learning process. Seeking students' opinion on issues concerning teaching and learning is very crucial and a step in the right direction because, students tend to be the direct beneficiaries of most of the activities facilitated by the teacher in the classroom. Ahmed and Aziz (2009) argued that collecting information from students regarding their teachers' teaching provides meaningful data on what their teacher does. Ahmed and Aziz further noted that students' perception of their teacher's teaching contribute very much in improving the teaching and learning of the subject as it provides valuable suggestions and directions for their teacher's future improvement (Ahmed & Aziz, 2009). In support of the argument made by Ahmed and Aziz, assessing teachers teaching practices using students' ratings and feedback according to Arthur, Tubre, Paul and Edens (2003) has proved to be reliable, variable and one of the best methods of measuring teachers' instructional practices. In addition, Arthur et. al. (2003) are of the opinion that the current system of assessing teachers by examining their own perceptions of their teaching is neither reliable nor valid, since it most often considers students' views as unimportant although students are directly affected by the teacher's actions and

inactions. Also, Ampadu (2012) in a study found that students were in a better position to provide useful information regarding their teachers' teaching and how that impacts on their learning. Also, Fogarty & Hogan (2009) maintained that collecting and estimating the perception of students is an effective procedure in evaluating the quality of the learning process.

Negative perceptions of students have influence on their performance in Physics courses as confirmed by Bamidele (2001) who reported that students' lack of interest in physics is due to their perception that physics is a difficult subject. In a similar study carried out with the purpose of examining the perception of undergraduate students towards their teachers, it was found that all the students did not feel good about some of their teachers' behaviour and attitude when they taught their students (Jasia, Nurul & Sarif, 2018). Saleem & Qureshi (2011) found that perception of students about teaching and learning may be a factors that can influence students' academic performance which includes the involvement of the students in the class and information the students know about the subject. The study done by Leeson, Ciarrochi & Heaven (2008) also revealed that there was significant relationship with the students' positive perceptions in learning towards their academic performance. Ferreira, Aldónio and Santoso, Andrijani (2008), studied the effect of students' perceptions on academic performance. The study involved undergraduate and graduate students enrolled in management accounting subjects. Findings indicate that students' performance is negatively affected by the negative perceptions students of accounting subject students have. It was further revealed that positive perceptions of accounting held by students at the end of the semester have a positive impact on students' performance. It was revealed in a similar study that there exist a significant ($P < 0.05$) effect of perception towards performance in Mathematics among students.

Female students had negative perception towards Mathematics. Most of the female students with negative perception performed poorly in Mathematics. Female students' in boarding schools were established to have more positive perceptions towards Mathematics and therefore performed better in the subject than students from co-educational schools. This tends to suggest that students' performance will largely be shaped by their perception to Mathematics. However, good academically the student is, the perception creates an impetus into the student's mind which creates a culture to like or dislike the subject. When these students' perceptions are not strengthened towards an undertaking, they often don't do quite well academically, even though they have the ability to do well under conducive environment. The researchers therefore concluded that performance of Mathematics can be improved through enhancing positive perception towards Mathematics. (Anne, Ndurumo & Kisilu, 2013) It must be noted that the more interest students develop for a subject, the higher grades they will get. Rohana, Nor Rashidah & Zaidi (2009) maintained that to achieve a good academic performance, the perception of students is significant as well as the involvement of teachers in students' study. On the contrary, Akkoyunlu & Soylu (2008) argued that there was no significant difference between students' achievement and their learning styles developed with their own perceptions in order to make efficient learning to occur learning styles.

Previous research shows that students' negative perceptions about a particular subject are likely to affect their interest for the subject. (Hunt et al., 2004; Parker, 2000; Siegel, 2000; Wessels & Steenkamp, 2009; Ferreira & Santoso, 2008; White & White, 2003). Empirical review (Ampadu, 2012; Bamidele, 2001) has also revealed the need to pay attention to students' perception. It has also been revealed from literature (Ahmed & Aziz, 2009; Arthur et. al., 2003) that seeking students' opinion

on issues concerning teaching and learning is very crucial and a step in the right direction because, students tend to be the direct beneficiaries of most of the activities facilitated by the teacher in the classroom.

2.2.0 Conceptual Review

2.2.1 Pedagogical skills

The ways in which teachers think about what goes on in the classroom and how they conceptualize their roles in working with students have been a subjects of broad attention in education research (Spike, 2014). How teachers manage their classrooms is an important part of achieving an effective learning environment. Pedagogical approaches teachers use in the classroom influence students' learning. Pedagogy is the interactions between teachers, students, the learning environment and the learning tasks. This includes how teachers and students relate together as well as the instructional approaches implemented in the classroom (Murphy, 2008). So and Brush (2008) stressed on active interactions between learners and instructors or between learner and learners in every learning environment. Despite the existence and use of variety of pedagogical approaches in schools, some strategies are more effective and appropriate than others. The effectiveness of pedagogy often depends on the particular subject matter to be taught, on understanding the diverse needs of different learners, and on adapting to the on-the-ground conditions in the classroom and the surrounding context. (Westbrook et al., 2013). Empirical evidences available in literatures has established why teachers' knowledge of pedagogy and subject matter is highly essential for effective teaching. It's confirmed that a teachers' teaching is influenced by the level of his pedagogical knowledge, as different from his subject matter knowledge. It is to be noted that pedagogical knowledge is not exactly the same thing as knowledge of subject matter, they nevertheless are, intimately linked,

because teachers' mastery and use of their pedagogical content knowledge in the classroom will indicate the depth of their knowledge of subject matter. (Anne, Ndurumo & Kisilu, 2013)

In general, the best teacher carefully utilizes a range of pedagogical approaches to ensure understanding and effective student's learning. Application of an effective pedagogy by the teacher in the classroom can lead to higher academic achievement, acquisition of technical skills as well as general ability to contribute to society. (Conn, 2014; Kremer & Holla, 2009). It important that Physics instructors should not only develop a robust understanding of physics content, but also refine strategies to teach that same content in ways that build upon students' prior knowledge. (Spike, 2014) Professional learning programmes should support teachers to deepen their pedagogical content knowledge to make learning for their students interesting and relevant. (Buabeng, 2018)

2.2.2 Pedagogical Content Knowledge (PCK)

Teachers' knowledge consists of an integration of their pedagogical knowledge (what teachers know about teaching) and knowledge of subject matter (what teachers know about the content that they teach). The blending or amalgamation of pedagogy and subject content knowledge and was introduced by Shulman in the 1980s. Pedagogical content knowledge is the overlapping part of a teacher's content knowledge and a teacher's pedagogical knowledge of teaching and learning. Having a strong PCK enables a teacher to choose appropriate instructional strategies (e.g. games, manipulatives, technology) embedded within a structure (e.g. cooperative learning, inquiry, problem-solving) to successfully deliver the content. A person who has great knowledge in physics may still not possess pedagogical content knowledge.

PCK entails 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. (Mishra & Koehler, 2006; Srisawasdi, 2012)

Pedagogical content knowledge (PCK) includes the most useful forms of representation of topics, the most powerful analogies, illustrations, examples, explanations and demonstrations. The methods of representing and conveying the subject that make it comprehensible to others. PCK also 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. Pedagogical content knowledge is an accumulation of common elements;

i. Knowledge of subject matter
ii. Knowledge of students and possible misconceptions
iii. Knowledge of curricula
iv. Knowledge of general pedagogy

In summary, PCK is knowing what, when, why, and how to teach using a reservoir of knowledge of good teaching practice and experience.

2.2.3 Technological Pedagogical Content Knowledge (TPACK)

The conceptual framework of TPACK was used to illustrate instructional ideas regarding how teachers integrate technology into their pedagogy and it has been embraced as a theoretical basis for structuring ICT curriculum in teacher education programs (Chai et al., 2011; Jimoyiannis, 2010). The technological pedagogical content knowledge (TPACK) is currently considered as an effective framework for

promoting instructional competency of the 21st century teachers. Computer-based learning environments have become commonplace in teaching practice toward building more effective approach for students learning process. The TPACK provides opportunities for teachers in solving the problems associated with infusing ICT into classroom teaching practice and learning process (Chai et al., 2011). Researches on teacher education reported that the TPACK model can be used as a potentially fruitful framework to prepare and develop teacher competencies in school teaching (Doering et al., 2009; Lee & Tsai, 2009; Voogt et al., 2009).

TPACK was firstly proposed by Mishra and Koehler (2006) to illustrate an integrated connection among content knowledge, pedagogical knowledge and technological knowledge in order to aid the potential integration of ICT tools in classroom setting and school practices. The TPACK framework includes three basic classifications of knowledge including the knowledge of methods of teaching and learning called pedagogical knowledge (PK), knowledge about the actual subject matter that is to be learned or taught called content knowledge (CK), and the knowledge about standard technologies and the skills required to operate particular technologies called technological knowledge (TK). The Mishra and Koehler (2006) framework also proposes that combining these three core types of knowledge results in four additional types of knowledge including the knowledge about particular teaching practice that appropriately fit the nature of specific subject content called pedagogical content knowledge (PCK), the knowledge about the existence, components and capabilities of standard technologies that could be appropriately used to particularly support in the processes and practices or methods of teaching and learning called technological pedagogical knowledge (TPK), the knowledge about the manner which knowledge of actual subject matter could be manipulated into

appropriate representations by the application of standard technologies called technological content knowledge (TCK), and knowledge about the manner which the transactional relationship between knowledge about content (C), pedagogy (P), and technology (T) was dynamic in order to develop appropriate, context-specific, strategies, and representations for better learning of content knowledge called technological pedagogical content knowledge (TPACK). The figure 1 below is the diagram of TPACK framework.

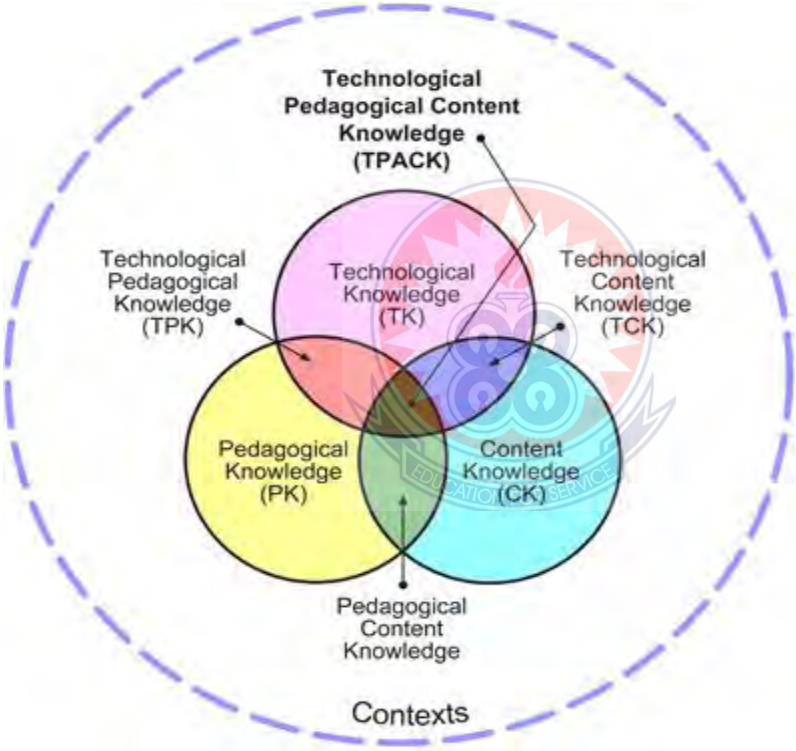


Figure 1*: *Technological Pedagogical Content Knowledge (TPACK) framework (Mishra and Koehler, 2006)

2.2.4 Classroom assessment

Classroom assessment is an integral part of daily instruction. It requires planning specific ways to use assignments, class exercises, test and discussions to discover what students do and do not understand. It also requires teachers to be prepared to deal with students' responses. Merely recognising when students are

incorrect is relatively easy compared with understanding the reasons behind their errors. The latter demands careful attention and a deep knowledge of the concepts and principles that students are learning. The insights teachers gain by making assessment a regular part of instruction enable them to meet the needs of their students. (Burns 2005). This makes classroom assessment central to the teaching–learning process, facilitating student learning and improving instruction.

According to Akker (2003), assessment is a method for obtaining information in order to make informed decisions about curriculum, student learning and other educational programs. According to Stiggins (2002), assessment has two main purposes: assessment for accountability and assessment for learning. Teachers use assessment for learning to provide information for students to advance, rather than merely checking on student learning. Assessment can also help teachers improve the teaching-learning process by aligning assessment with the national content standards for physical education (Stiggins, 2002). One other importance of classroom assessment is to draw the attention of students to instructional priorities and influence them to concentrate on crucial aspects of what they learn in the school setting. (Mikre, 2020). Assessment is noted to be a powerful diagnostic instrument that enables teachers understand the areas in which students are having difficulty so they can concentrate their efforts in those areas. (Ali, Sultana & Marwat, 2010). Research has revealed that assessment helps students to focus on learning and better understand teacher expectations (James, 2001).

Classroom assessment is generally divided into three types: assessment for learning (formative assessment), assessment of learning (summative assessment) and assessment as learning. The philosophy behind assessment for learning is that assessment and teaching should be integrated into a whole. The power of such an

assessment doesn't come from intricate technology or from using a specific assessment instrument. It comes from recognizing how much learning is taking place in the common tasks of the school day and how much insight into student learning teachers can obtain from this material. (McNamee & Chen 2005). Assessment for learning is ongoing assessment that allows teachers to monitor students on a day-to-day basis and modify their teaching based on what the students need to master (Stiggins, 2004). This assessment provides students with the timely, specific feedback that they need to make adjustments to their learning. Burns (2005) if of the view that after teaching a lesson, teachers need to determine whether the lesson was accessible to all students while still challenging to the more capable; what the students learned and still need to know; how we can improve the lesson to make it more effective; and, if necessary, what other lesson we might offer as a better alternative. This continual evaluation of instructional choices is at the heart of improving our teaching practice. (Burns, 2005). After a thorough review of series of literature on formative assessment, Muoneke and Times (2012) came to the conclusion that, it is a systematic, continuous process used during instruction that provides a feedback loop to check for progress and detect learning gains, identify strengths and weaknesses and narrow gaps in learning. The formative assessments aim to see if the students understand the instruction before doing a summative assessment which usually takes place at the end of the instruction (Mctighe & O'Connor, 2005).

On the other hand, Summative assessment is evaluative in nature and is usually carried out at the end of a course or educational programme. It enables teachers, students and their parents know how well each student has completed the learning tasks and activities. It provides information about student achievement. In an educational setting, summative assessments are made to summarize what students

have learned, to determine whether they understand the subject matter well and are mainly used in grading students. (Mctighe & O'Connor, 2005). Assessment of learning is usually designed for the information of those not directly involved in daily learning and teaching such as school administration, parents and school board. (Alberta Assessment Consortium, 2003). Assessment as learning develops and supports students' metacognitive skills. This form of assessment is crucial in helping students become lifelong learners. As students engage in peer and self-assessment, they learn to make sense of information, relate it to prior knowledge and use it for new learning. Students develop a sense of ownership and efficacy when they use teacher, peer and self-assessment feedback. (Alberta Assessment Consortium, 2003)

Assessment can be either formal or informal. Formal assessment is mainly in the form of a written document, such as a test, quiz, or paper. A formal assessment is given a numerical score or grade based on student performance, whereas an informal assessment does not contribute to a student's final grade. An informal assessment usually occurs in a more casual manner and may include observation, inventories, checklists, rating scales, rubrics, performance and portfolio assessments, participation, peer and self-evaluation as well as discussion. This current study will concentrate on both formal and informal formative assessment types used in the physics classroom.

2.2.5 Teaching and learning resources

Eniayeju (2005) defines instructional aids as any object or device used by physics teachers to enhance teaching and learning in the classroom. Isola (2010) refers to instructional materials as objects or devices, which helps the teacher to make a lesson much clearer to the learner. In this present study, resource refers to materials used purposely for teaching and learning of physics in the classroom. The term ‘teaching and learning resource’ as used in this study is similar to what other

researchers refer to as instructional aids or materials. These resources may be technological tools such as computers, computer programs (e.g. simulation), other ICTs, improvised tools, scientific instrument, audio visuals, electronically operated materials like Television, Radio, Film and non-electronic ones such as chalk board, graph board, charts. Etc. These are materials that when teachers use, can appeal to student both sight and hearing. The presence of these materials in teaching of physics can make learning very interesting and encouraging to students and hence lead to high academic achievement.

2.2.6 Motivation of students

Kim and Garman (2004) define motivation as the driving force within an individual by which they attempt to achieve some goal in order to fulfil some needs or expectations. Brophy (2010) also defines Students' motivation as "students' subjective experiences, especially those connected to their willingness to engage in learning activities and their reasons for doing so". Motivation is one of the principal factors that affect students' learning process.

Motivated students can perform well academically by actively participating in class and laboratory activities such as asking questions, seeking advice and studying. (Schunk, Pintrich, & Meece, 2008). Aggarwal (2008) argued that motivation is the very heart of learning process. According to Aggarwal, adequate motivation not only sets in motion the activity which results in learning, but also sustains and directs it.

2.2.7 Students' perception

According to Haman et al. (2012), perception is an individual's evaluation of real-world events. A way individuals evaluate people with whom they are familiar in

everyday life. Eggen and Kauchak (2001) gave cognitive dimension of perception; they see perception as the process by which people attach meaning to experiences.

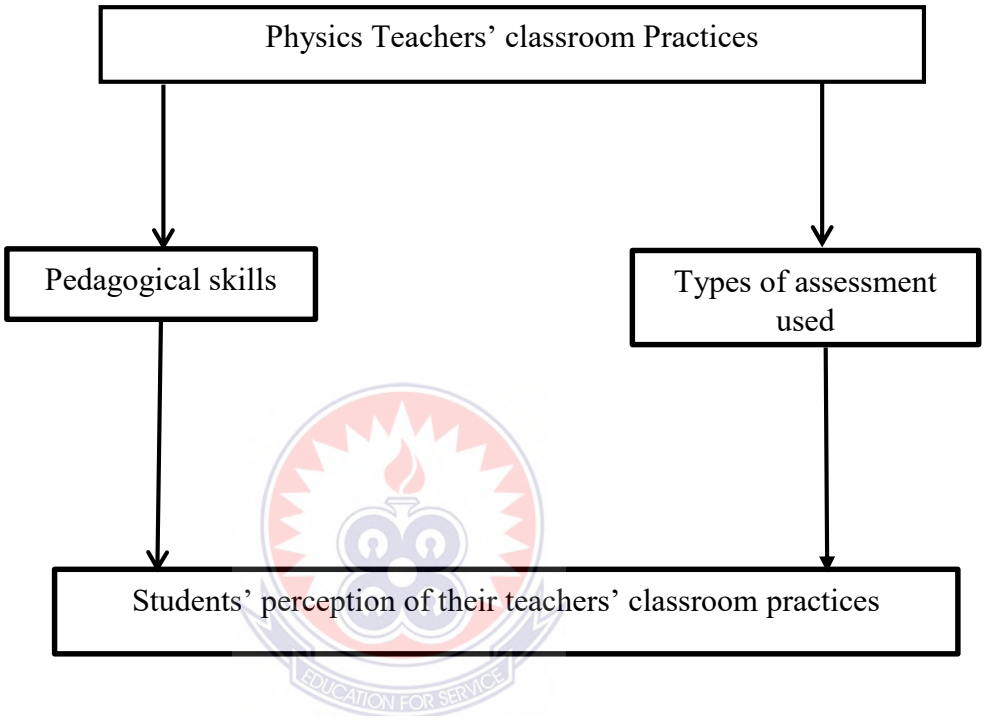
According to Ou (2017), perception is a process and consists of three stages namely, selection, organization and interpretation. At the selection stage, one convert stimuli from the environment into meaningful experience. During the organization stage, one finds certain meaningful patterns and organize our experiences by putting things or people into categories. one finally attach meaning to the selected stimuli at the Interpretation stage. Fundamental to perception is that, there is an experiencing person (perceiver) secondly, something is being perceived (either an object, person, situation or relationship); thirdly, there is the context of the situation in which objects, events or persons are perceived and finally, there is the process nature of perception starting with the experiencing of multiple stimuli by the senses and ending with the formation of precepts.

From the researchers' point of view, perception can simply be defined as an individual's interpretation of the information gathered through the senses about an object, person, situation or relationship. Specifically, students' perception of their teacher's classroom practices can be defined as students' interpretation of their teacher's actions or practices to ensure effective teaching and learning in the classroom. It is a common opinion held by students concerning the teaching and learning activities facilitated by their teacher in the classroom. Students' perception of teachers' knowledge of subject matter, attitudes to work and teaching skills is absolutely dependent on the fact that they have been taught by the teachers under evaluation and are familiar with them. (Anne, Ndurumo & Kisilu, 2013). Generally, perceptions of students eventually form part of their beliefs which in turn can

influence their career choices (Ferreira & Santoso 2008; Hunt et al., 2004; White & White, 2006).

2.2.8 Conceptual framework

Figure 2: Conceptual Framework



Physics teachers' classroom practices comprise of a number of activities carried out in the classroom with the aim of ensuring effective acquisition of knowledge by students. Key among these practices are the careful selection and use of various pedagogical skills, assessment practices coupled with classroom and students' behavioural management practices. These practices are crucial as it is not enough for physics teachers to only develop a deep understanding of physics content knowledge but instead must equally be equipped with knowledge of methods of representing and conveying the subject that makes it comprehensible to students. There is also the need for physics teachers to be knowledgeable in techniques for obtaining information in

order to make informed decisions about curriculum, student learning and other educational programs. Physics teachers' ability to draw the attention of students to instructional priorities and influence them to concentrate on crucial aspects of what they learn enables them to understand the areas in which students are having difficulty so they can concentrate their efforts in those areas. Also worth noting is the fact that teachers' practices in the classroom have influences on students and therefore contribute to their attitude and perception about their teachers and the subject they teach. There are empirical evidences that indicated that perception of students about teaching and learning may be a factors that can influence students' academic performance (Ferreira & Santoso, 2008; Hunt et al., 2004; Parker, 2000; Saleem & Qureshi, 2011; Siegel, 2000; Wessels & Steenkamp, 2009; White & White, 2003).)

In a nut shell, to ensure that students effectively study, understand and develop the desire for physics related careers, physics teachers must be mindful of their classroom practices. Effective classroom practices comprise but not limited to teachers knowing what, when, why, and how to teach using a reservoir of knowledge of good teaching practices and experience. Teachers must also ensure that their students are motivated, develop interest and positive perception towards the subject they teach.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This chapter entails a description of the research design employed in carrying out the study and a justification for the choice of the design. This chapter also gives an account of the population, sampling procedure employed in obtaining samples for the study as well as the instruments and procedure for data collection, management and analysis. The challenges likely to be encountered using the research design and the instrument(s) employed were also highlighted.

3.1 Research Design

In this study, descriptive survey design specifically, cross-sectional survey was employed in carrying out the study. According to Cohen, Manion and Morrison (2018), surveys gather data at a particular point in time with the intention of describing the nature of existing conditions. Wisker (2001) indicated that descriptive survey design enables researchers to find out more about a phenomenon without manipulation of variables and captures it with detailed information. Orodho (2009) is also of the view that, descriptive survey design is used in preliminary and explorative studies to allow researchers to gather information, summarise, present and interpret them for the purpose of clarification.

In a cross-sectional survey design, the researcher collects data at one point in time. The design has the advantage of enabling the researcher measure current attitudes or practices (Creswell, 2012). Surveys enable researchers gather data on a one-shot basis and hence it is economical and efficient (Cohen, Manion & Morrison, 2018). Such an approach does not involve the manipulation of variables in the study. It neither adds to nor subtracts from the existing facts. With the cross-sectional

design, the researcher carefully observes and records data as the phenomenon naturally occurs at the time the study is conducted. Cross-sectional designs are effective for examining current attitudes, beliefs opinions or practices. Practices are the actual behaviours of the research subjects (Creswell, 2012). This design also has the advantage of providing data relatively quickly. Cross-sectional studies are not effective if the researcher's goal is to understand trends or development over time. Furthermore, a single point in time often does not provide a broad enough perspective to inform decisions about changes in processes and systems reliably (Gay, Mills & Airasian, 2012)

Fraenkel and Wallen (2012) indicate that the descriptive cross-sectional design has some weaknesses which include the difficulty of ensuring that a sufficient number of questionnaires are administered for meaningful analysis to be made. In order to mitigate the effects of the weaknesses associated with the use of descriptive survey for the study, the questionnaire was pilot tested. This offered the researcher the opportunity to reframe and correct ambiguous items. Additionally, respondents were assured of their anonymity and the confidentiality of responses provided to enable them to respond candidly and dispassionately. Also, in some instances after administering the instrument, the researcher waited for respondents to fill in their responses and collected them. Based on the strengths of the research design and the measures put in place to eliminate or reduce the impact of it weaknesses, the researcher deems it appropriate for the study.

3.2 Population of the Study

According to Williaman (2011), Population is a collective term used to describe the total quantity of the subject of study. In other words, population is the larger group to which the researcher would like the results of a study to be

generalised. (Lodico, Spaulding & voegtle, 2006). The target population is the group of interest to the researcher. It is the group from whom the researcher would like to generalise the results of the study. (Lodico, Spaulding & Voegtle, 2006). Alvi (2016) also defines target population as all the members who meet the particular criterion specified for a research investigation. The accessible population is a portion of the population to which the researcher has reasonable access; it may be a subset of the target population. In other words, it is the population from which the researcher can realistically select subjects, which is also known as the available population (Gay, Mills & Airasian, 2012).

In this study, the target population was made up of all Senior High School elective physics teachers in the Hohoe Municipality in the Volta Region of Ghana. Physics students studying under these teachers were also involved in the study.

The Hohoe municipality can boast of about eight (8) Senior High Schools. Classroom practices of physics teachers is similar in all parts (regions) of the country but Hohoe municipality was randomly selected as a case to represent what prevails in others parts of the country. This municipality is also of much interest to the researcher because, the population is easily accessible to the researcher. The familiarity of the study area to the researcher also enhanced easy movement and access to important information and other resources needed to effectively conduct the study.

3.3 Sample and Sampling Procedure

Sample is a subgroup of the target population that the researcher plans to study for the purpose of making generalizations about the target population. (Creswell, 2012). The quality of any research not only stands or falls by the appropriateness of methodology and instrumentation but also by the suitability of the sampling strategy that is adopted (Cohen, Manion & Morrison, 2007). There are several sampling

techniques. Commonly used sampling procedures in qualitative research include simple random sampling, purposeful sampling, snowball sampling, convenience sampling and quota sampling (Leavy, 2017). According to Patton (2015), qualitative research typically relies on purposeful sampling, which is based on the premise that, seeking out the best cases for the study produces the best data.

In this study, the sample was purposely and randomly selected from the portion of the population accessible to the researcher using simple random sampling. Random selection is a procedure where each and every person in the population has an equal and independent chance of being selected for the study (Lodico, Spaulding & voegtle, 2006; Gay, Mills & Airasian, 2012). Random sampling techniques are based on the theory of probability and usually produce sample which is often a good representative of the population it came from (Johnson & Christensen, 2014).

Sample for the study consisted of 25 physics students from each of the 8 Senior High Schools in the municipality and 2 elective physics teachers in 2 selected schools in the municipality. A total number of 200 elective physics students and 2 Physics teachers took part in the study in addition to 16 students who were interviewed (2 from each of the 8 schools). Cohen, Manion and Morrison (2018) indicated that there is no clear cut answer for the question of how large the sample size of a research should be as it will depend on the purpose of the study and the population under study.

3.4 Research Instrument

Researchers employing survey in their study typically collect data using two basic forms: questionnaires and interviews (Creswell, 2012). A questionnaire consists of a set of questions used in a survey design that participants in a study complete and return to the researcher. The research subjects provide their basic personal or

demographic information and select an option that best answers a set of questions (Creswell, 2012). Questionnaires offer benefits of standardised and open responses to a range of topics from a large sample or population. They can be cheap, reliable, valid, quick and easy to complete (Cohen et al., 2018).

Questionnaire is considered appropriate in descriptive survey where the number of respondents is high (Orodho, 2009). Questionnaires also offer the advantage of being easy and cost-effective to administer to a large population. An interview involves the gathering of data through direct verbal interaction between individuals (Cohen et al., 2018). Hochschild (2009) notes that interview explores issues in depth, to see how and why people frame their ideas in the ways that they do, how and why they make connections between ideas, values, events, opinions and behaviours. They can be used to cast further explanatory insight into survey data. Observation in research is a means of systematically taking note of people, events, behaviours, settings, artefacts, routines etc. (Simpson & Tuson, 2003; Marshall & Rossman, 2016). It can be systematic and structured or take some less structured form such as participant observation (Denscombe, 2014, p. 205).

In this study, questionnaire, interview and observation schedule were employed to collect data for the study. Questionnaires was used to gather data from the students on physics teachers' pedagogical skills employed in teaching physics and their perception concerning their physics teachers' classroom practices. The questionnaire was made up of Four (4) sections. Section one consist of items to obtain background information of the students. Other items on the questionnaire were grouped under the three (3) research questions. A five-point Likert scale format consisting of Always (Al), Often (O), Never (N), Sometimes (S), Rarely (R) was used to help students respond to the items on the questionnaire.

This study used interview schedule to gather additional information from the Physics teachers and some students who voluntarily availed themselves. Interview schedules are considered appropriate when the sample is small since a researcher is able to get more information from respondents than when using a questionnaire. The interview guide items were under themes. Each theme had a main question which will guide and help the researcher come out with subsequent questions. The researcher sat in a physics classroom during physics lesson in 2 selected schools in the municipality, observed and recorded activities in the physics classroom using observation schedule adapted from the teaching practice assessment form A of the Centre for Teacher Professional Development, University of Cape Coast.

Data obtained from these three instruments were compared to determine consistency in the information gathered and hence ascertain the accuracy and reliability of the data gathered. Various studies have indicated that Triangulation and comparison of data from multiple sources leads to trustworthiness and to the credibility of interpretation (Bogdan & Biklen, 2007; Cohen et al., 2007; Keser, Akdeniz, & Yyu, 2010; Sarantakos, 2005; Yin, 2009). It also enables researchers to probe deeper into issues that might not be possible to obtain from questionnaires alone (Fraenkel, Wallen, & Hyun, 2012). These findings informed the researchers' decision of using multiple means of data collection.

3.5 Validity and Reliability of Research Instruments

Triangulation is a commonly used strategy by researchers whereby multiple methods or sources of data are used to address the same question. Triangulation is very important because it is a primary way that qualitative researchers ensure the trustworthiness (i.e. validity and reliability) of their data (Greene, 2007; Hesse-Biber

& Leavy, 2005, 2011). This study therefore triangulated sources of data and instruments to ensure the validity and reliability of data collected.

The instruments were also validated through content validity using expert judgement. Content validity refers to the degree to which the sample of the items represents the content that it is designed to measure. (Orodho, 2009). According to Creswell (2012), content validity is the extent to which the questions on the instrument and the scores from these questions are representative of all the possible questions that could be asked about the content or skills. The Researcher assessed content validity through the use of professionals in the field of science (Physics) education. The Researcher also discussed with his supervisor, other lecturers and colleagues on whether the instruments accurately represent the concept of the study. Their ideas were well considered and appropriately incorporated. The instruments were also pilot tested in one of the senior high schools in the Cape Coast metropolis. Piloting is important because it helps in revealing deficiencies in a research instrument such as questionnaire (Mugenda & Mugenda, 2003). The researcher then addressed the deficiencies revealed by the piloting exercise.

There are a number of different aspects to reliability. One of the aspects is to check for internal consistency. Internal consistency refers to the degree to which items that makes up a scale "hang together" or measure the same underlining construct. (Pallant, 2007). Cronbach's alpha coefficient was used to check the reliability of the items on the questionnaire. According to DeVellis (2003), Cronbach's alpha coefficient of a scale should be above 0.7. A sample size of 21 students from the pilot study yielded a Cronbach's alpha coefficient value of 0.806.

3.6.0 Data Collection Procedure

Gay, Mills and Airasian (2012) are of the view that data collection approaches are acceptable provided they are ethical, feasible and contribute to an understanding of the phenomenon under study. According to Creswell (2012), it is important to give much reverence to all individuals in the study site where the research takes place. "This respect should be shown by gaining permission before entering a site, by disturbing the site as little as possible during a study and by viewing oneself as a "guest" at the place of study" (Creswell, 2012. Pp 23).

Personal visits were made to the schools with a letter obtained from the Department of Science Education, University of Education, Winneba introducing the researcher and the need to be assisted to collect data for the study. In collecting data from the participating schools, the purpose of the study was explained to the head of the schools and the science (Physics) students and teachers who were involved in the study. This was done to ensure effective collaboration and participations of the research subjects in the schools involved.

3.6.1 Pilot testing

Before the main data collection, the research instruments (the questionnaire, observation and interview schedule) were pilot tested in one of the senior high schools in the Cape Coast Metropolis. This enabled the researcher to assess the clarity of the items on the instruments so that those items found to be ambiguous were either discarded or modified to improve the quality of the research instruments and the data collected. It also allowed the researcher to create familiarity with the instrumentation.

3.6.2 Questionnaire and interview

The student respondents were given instructions and assured of confidentiality and anonymity after which they were given enough time to respond to the items on the questionnaires and during the interview schedule. Twenty-five physics students were randomly selected from each of the eight schools selected for the study to respond to the items on the questionnaire. Two students were randomly selected out of all students who voluntarily availed themselves and interviewed in each of the 8 schools selected for the study.

3.6.3 Focus group discussion

One-on-one interview was followed by focus group discussion among students whose class and exercise books were observed. All the students in a particular class were put into four groups, allowed to interact with each other in the group and agree on a common answer to the interview question asked by the researcher. It is from the interaction of the group and views from the leader of each group that the researcher noted down the views of the students. Focus groups discussions are advantageous because it is believed that the interaction among interviewees will likely yield the best information (Creswell, 2012).

3.6.4 Observation

The researcher also observed and recorded activities of physics teachers in the classroom during a Physics lesson in 2 selected schools. The note books and exercise books of physics students taught by the two teachers who were observed were also reviewed to ascertain the pedagogical skills and types of assessment physics teachers often use in teaching their students. The checklist for inspecting students' notebooks and exercise books consisted of some pedagogical skills and commonly used assessment techniques employed by teachers in teaching.

3.7 Data Analysis

After editing and coding, the data was keyed into the computer using the Statistical package for Solutions and Services (SPSS) software as well as Microsoft excel. Before performing the desired data transformation, corrections were made after verification from the questionnaires and the database was generated. The data was analysed using descriptive statistics involving mainly mean and standard deviation.

In analysing the data on the questionnaire, values of 1 to 5 was assigned to the Likert scale format (i.e. 5-Always, 4-Often, 3-Undecided/neutral/never, 2-Sometimes and 1- Rarely). For negative item, the reverse values were assigned (1-Always, 2-Often, 3-Undecided/neutral/never, 4-Sometimes and 5-Rarely). A midpoint values of three (3) was chosen which indicate that, for each item answered, an average value above three (3) obtained was considered as a positive opinion or perception and mean values below 3 obtain was considered negative opinion or perception (Pallant, 2011; Korb, 2013; Kent State University Libraries, 2021).

In analysing the data gathered during observation, the total marks obtained by each teacher for all the items is calculated and the values obtained for each of the three days are added up and compared with the total mark that would have been obtained by the teacher if he/she had scored the highest mark in all cases. The total mark and percentage scored by each teacher helps to determine the performance of that teacher. Also, the responses given during the one-on-one and focus group interviews were matched with the observed behaviour and discussed. The frequencies of occurrences of usage of some pedagogical skills and commonly used assessment techniques as observed in the notebooks and exercise books of students were calculated, presented and discussed.

Responses obtained from interviews were thematically analysed. The various responses were carefully considered, put under themes, subthemes, presented and discussed. Whilst information gathered through observation was presented as recorded using the observation schedule/guide and discussed by comparing and contrasting with the information obtained from the questionnaire and during the interview.

CHAPTER FOUR

PRESENTATION OF RESULTS

4.0 Overview

In this chapter, data collected were subjected to statistical analysis using the Statistical Package for Solutions and Services (SPSS). The analysis was based on the responses provided through questionnaires and interview guide by respondents and observation made by the researcher. Information obtained is presented in the form of tables. Frequencies, percentages, mean and standard deviations were used in the analysis.

In analysing the data on the questionnaire, values of 1 to 5 was assigned to the Likert scale format (i.e. 5-Always, 4-Often, 3-Never, 2-Sometimes and 1- Rarely). For negative item, the reverse values were assigned (1-Always, 2-Often, 3-Never, 4-Sometimes and 5-Rarely). A midpoint values of three (3) was chosen which indicate that, for each item answered, an average value above three (3) obtained was considered as a positive opinion or perception and mean values below 3 obtain was considered negative opinion or perception (Pallant, 2011; Korb, 2013; Kent State University Libraries, 2021).

The total and percentage scored by each teacher during the observation helps to determine the performance of that teacher. Also, the responses given during the one-on-one and focus group interviews were matched with the observed behaviour and discussed. The frequencies of occurrences of usage of some pedagogical skills and commonly used assessment techniques as observed in the notebooks and exercise books of students were calculated, present and discussed.

Responses obtained from interviews were thematically analysed. The various responses were carefully considered, put under themes, subthemes, presented and discussed.

4.1 Demographic Data of Respondents

The study involved a total of 200 second and third year senior high school physics students in the Hohoe Municipality of the Volta Region. These students were selected from 8 different senior high schools. The details of the age distribution of student respondents are presented in Table 1.

Table 1: ***Demographic data of respondents***

Demographic Data	Frequency	Percentage (%)
Age(in years)		
13-15	6	3.0
16-18	157	78.5
19-21	33	16.5
Above-22	4	2.0
Sex		
Male	163	81.5
Female	37	18.5

Field Data, 2021.

Out of the 200 respondents, 163 (81.5%) were males and 37 (18.5%) were females. Majority 157 (78.5%) of the student respondents are between the ages of 16 to 18 years, 33 (16.5%) are in the 19 to 22 years age range whiles six of the student respondents are in the 13 to 15 years age range. A total of 137 second year students and 63 third year students were involved in the study.

4.2 Research Question 1: What are the Pedagogical Skills Employed by Physics Teachers in Teaching at the Senior High School Level?

The answer to the above question was obtained through a students' questionnaire and their responses are shown in Table 2 in terms of number and percentage of students at each item.

Table 2: ***Pedagogical skills employed in the teaching of physics***

Items	AL n(%)	O n(%)	N n(%)	S n(%)	R n(%)	Mean	SD
1. Cites examples from daily life	7(3.5)	63(31.5)	3(1.5)	31(15.5)	96(48)	2.27	1.417
2. engages all of us during each lessons	12(6)	46(23)	8(4)	34(17)	100(50)	2.18	1.406
3. goes very fast when teaching	25(12.5)	14(7)	52(26)	79(39.5)	30(15)	3.38	1.196
4. Speaks clearly and loudly	2(1)	35(17.5)	4(2)	27(13.5)	132(66)	1.704	1.187
5. Correct our mistakes when we answer questions wrong	6(3)	24(12)	8(4)	37(13.5)	135(67.5)	1.70	1.174
6. Put us in groups and asks us to teach one another	34(17)	54(27)	68(34)	19(9.5)	25(12.5)	3.27	1.217
7. gives exercises which are marked and returned to us	35(17.5)	39(19.5)	30(15)	20(10)	76(38)	2.70	1.579

Field Data, 2021. Key: Always (Al), Often (O), Never (N), Sometimes (S), Rarely (R)

According to the students, their physics teachers performed averagely with regard to the pedagogical skills employed in teaching physics. Quite a high percentage of the students (34%) were of the view that their physics teachers do not encourage cooperative learning. Most students 135 (67.5%) pointed out their teachers rarely correct their mistakes when they answer questions wrongly during lessons whilst quite a number of them 37 (13.5%) indicated their teachers only do so sometimes. (Mean = 1.70, SD = 1.174). Students were also asked if their physics teachers make physics lessons interesting by citing lots of examples from daily life. Unfortunately, only seven (about 4%) students agreed their teachers always do so. Majority of the students 96 (48%) revealed their teachers rarely cite examples from daily life while teaching and this does not make physics exciting to study (Mean = 2.27, SD = 1.417). When students were asked if their physics teachers speak clearly and loudly enough while teaching, only 35 (17.5%) of the student respondents indicated their physics teachers are often audible. Also, 132 (66%) of the students pointed out that they rarely hear their physics teachers in class. With regards to physics teachers pace of teaching, quite a number of students 79 (39.5%) are of the view that their teachers go very fast when teaching as shown in Table 2.

Key findings 1:

i. According to physics students (67.5%) their physics teachers do not often respond appropriately to their wrong answers and misconceptions
ii. Majority of physics students (48%) also raised concerns about their physics teachers' inability to often link what they teach to their daily life occurrences.
iii. About 50% of the physics students indicated that their physics teacher do not often engage majority of them whilst teaching.

4.3 Research Question 2: What Types of Assessment are used by Teachers in the Teaching of Physics at the Senior High School?

The answer to the research question 2 was obtained using a students' questionnaire and other instruments (classroom observation checklist, interview schedule and checklist list for inspecting students' notebooks and exercise books). Presented in Table 3 are the result obtained using the students' questionnaire.

Table 3: ***Assessment techniques used by teachers in the teaching of Physics***

Assessment techniques	Al n(%)	O n(%)	N n(%)	S n(%)	R n(%)	Mean	SD
1. Oral question and answer	100(50)	72(36)	5(2.5)	15(7.5)	8(4)	4.50	1.072
2. Home work	14(7)	80(40)	10(5)	73(36.5)	23(11.5)	3.00	1.229
3. Class Exercise/Class test	113(56.5)	80(40)	0(0)	7(3.5)	0(0)	5.00	0.680
4. Peer-assessment	9(4.5)	14(7)	17(8.5)	133(66.5)	27(13.5)	2.00	0.927
5. Self-assessment	18(9)	24(12)	13(6.5)	119(59.5)	26(13)	2.00	1.137

Field Data, 2021. Key: Always (Al), Often (O), Never (N), Sometimes (S), Rarely (R)

Table 3 reveals that teachers most often employ oral questioning (Mean = 4.50, SD = 1.072), home work (Mean = 3.00, SD = 1.229) as well as class exercise and class test (Mean = 5.00, SD = 0.680). According to most of the student respondents (96.5%), class test and exercises are commonly used formative assessment employed by their physics teacher to ascertain the extent to which students have acquired knowledge impacted. Giving of trial examples (homework) to be

solved by students after classes is also a popular means of measuring students' understanding of what has been taught. Also, self and peer-assessment are the least used formative assessment technique used in assessing students. Only seven percent of students indicated they often use peer assessment whilst about five percent of them said they always do so. Majority of the students (59.5%) also mentioned that they rarely engage in self-assessment.

Key findings 2:

i. Interactive formative assessments through questioning in a form of dialogue is often used by majority of physics teachers

ii. knowledge test and teacher made test to be completed inside or outside the classroom by students are commonly used formative assessment practices of physics teachers

iii. Formative assessment techniques which enables students assess their own work or that of their peers using criteria developed by the instructor are rarely used by physics teachers

4.4 Research Question 3: What is the Perception of Students of their Physics Teachers' Classroom Practices?

Presented in Table 4 are the results obtained using students' questionnaire to enable the researcher answer research question 3. The results are present using descriptive statistics such as frequency, percentages, mean and standard deviation.

Table 4: ***Students' perception of their physics teachers' classroom practices***

	Items	AL n(%)	O n(%)	N n(%)	S n(%)	R n(%)	M	SD
1.	teaches in a way that helps me to learn effectively	7(3.5)	44(22)	12(6)	26(13)	111(55.5)	2.05	1.348
2.	helps me understand that things we learn in physics are important	7(3.5)	30(15)	7(3.5)	35(17.5)	121(60.5)	1.96	1.267
3.	gives clear explanation and directions	6(3)	37(18.5)	9(4.5)	39(19.5)	109(54.5)	1.96	1.267
4.	shows interest in my academic progress and success in life	8(4)	39(19.5)	15(7.5)	17(8.5)	121(60.5)	1.98	1.352
5.	Makes me more interested in studying physics	7(3.5)	56(28)	16(8)	29(14.5)	92(46)	2.29	1.380
6.	encourages me enough to study physics	5(2.5)	35(17.5)	10(5)	35(17.5)	115(57.5)	1.90	1.244
7.	uses the appropriate teaching and learning materials	16(8)	58(29)	27(13.5)	30(15)	69(34.5)	2.61	1.413

Field data, 2021. Key: Always (Al), Often (O), Never (N), Sometimes (S), Rarely (R)

Most of the students did not have good overall perception about their physics teachers' teaching (Grand Mean = 2.107). Only seven out of the 200 students revealed that, their physics teachers' teaching always makes them more interested in studying

physics (Mean = 2.29, SD = 1.380), their teachers teach in a way that helps them to learn effectively (Mean = 2.05, SD = 1.348), and makes them appreciate the fact that the things they learn in physics are important (Mean = 1.96, SD = 1.267). Most students are generally not satisfied with the teaching and learning materials used by their physics as 69(34.5%) and 30(15%) are of the opinion that their physics teachers rarely and sometimes use the appropriate teaching and learning materials during physics lessons respectively. Also worth noting is the widely held notion by most physics students 121(60.5%) that their physics teachers are often not interested in their academic progress and success in life. Table 4 also revealed that students are not often encouraged enough to study physics. This is evident from the results displayed in Table 4 which shows that 35(17.5%) of physics students are often encouraged to study physics whilst only 5 (2.5%) of the physics students are always motivated to study physics.

Key findings 3:

i. Majority of students (60.5%) held a negative perception about their physics teachers' interest in their academic progress.

ii. Most students 57.5% expressed concern about their physics teachers' inability to regularly motivate them to study physics. About three percent of the students mentioned that their physics teachers always encourage them to study physics.

iii. Majority of students expressed negative opinion with regards to their physics teachers' pedagogical skills. Majority of students (54.5%) pointed out that their physics teachers' explanations and directions during teaching are not clear to them most of the time. Also, 60.5% of the students indicated that their

physics teachers do not emphasise the importance of the physics concepts they teach in class.

4.5 Results from Classroom Observation

Two physics teachers in different schools were observed during a physics lesson on three different occasions in a week. During the classroom observation, pedagogical skills and assessment techniques employed by the physics teachers were noted and graded using a well-structured observation schedule. The researcher also observed the note books and exercises books of physics students. Below is a presentation of the result of the classroom observation. The total marks obtained by each teacher for all the items is calculated and the values obtained for the three days are added up and compared with the total mark that would have been obtained by the teacher if he had scored the highest mark in all cases.

Presented in Table 5 are the results obtained during the classroom observation of the pedagogical skills of two physics teachers using classroom observation checklist to enable the researcher answer research question 1. Each of the statements in Table 5 were responded to using the following scale: **5 = Very Good, 4 = Good, 3 = Satisfactory, 2 = Unsatisfactory, 1= Poor , 0 = Not observed.**

Table 5: ***Observation of physics teachers' pedagogical skills in the classroom***

Pedagogical Skills Used by the Physics Teacher	Teacher 1				Teacher 2			
	Day 1	Day 2	Day 3	Total %	Day 1	Day 2	Day 3	Total %
1. Explain major/minor points with clarity.	5	4	5	93.3	4	5	5	93.3
2. Define unfamiliar terms, concepts and principles.	5	4	5	93.3	4	5	4	86.7
3. Use good examples to clarify points.	4	3	3	66.7	5	5	4	93.3
4. Vary explanations for complex or difficult concepts.	4	5	2	73.3	3	3	4	66.7
5. Emphasize important points.	4	4	2	66.7	3	5	5	86.7
6. Integrates materials (examples, cases, simulations) from "real world".	4	3	2	60.0	5	1	5	73.3
7. Encourages collaborative and cooperative learning	5	4	2	73.3	4	1	5	66.7
8. Ask questions to monitor student understanding and actively encourage student questions	4	2	3	60.0	5	3	2	66.7
Total marks obtained.	**35**	**29**	**24**	**73.3**	**33**	**28**	**34**	**79.2**

Field Data, 2021 *Key: 5 = Very Good, 4 = Good, 3 = Satisfactory, 2 = Unsatisfactory, 1= Poor, 0 = Not observed.*

The physics teachers observed employed good pedagogical skills and performed very well especially in their ability to define unfamiliar terms, concepts and principles and explain major/minor points with clarity (Teacher 1: 93.3%, 93.3%; Teacher 2: 93.3%, 86.7%). The physics teachers' abilities in varying explanations for complex or difficult concepts (Teacher 1: 73.3%; Teacher 2: 66.7%), their use of good example from the real world to clarify points and explain difficult concepts (Teacher 1: 60.0%; Teacher 2: 73.3%) as well as actively encouraging students' questions needs improvement (Teacher 1: 60.0%; Teacher 2: 66.7%). Also worth

noting is the fact that teachers laid emphasis on collaborative and cooperative learning during teaching (Teacher 1: 73.3%; Teacher 2: 66.7%).

Key findings 4:

i. Contrary to findings from students (through the use of questionnaire) evidence from observation indicates that physics teachers possess and exhibited sufficient knowledge on diverse pedagogical skills.

ii. Physics teachers exhibited good knowledge on subject matter. This is evident in their ability to use good example from the real world to clarify points and explain difficult concepts

Table 6 displays the results obtained during the classroom observation of the assessment practices of two physics teachers using classroom observation checklist to enable the researcher answer research question 2.

Table 6: ***Classroom observation of Physics teachers' assessment practices***

	Teacher 1			Teacher 2		
Assessment Techniques Used By Physics Teachers	**Day 1**	**Day 2**	**Day 3**	**Day 1**	**Day 2**	**Day 3**
1. Oral questioning and answer	√	√	√	√	√	√
2. Home work	√	×	√	√	×	√
3. Class exercise/class test	×	×	×	×	×	√
4. Observation of students' participation and progress	×	×	√	×	×	×
5. Peer-assessment	×	×	×	×	×	×
6. Self-assessment	×	√	×	×	×	×

Each of the statements were responded to using the following √ = Present/Used, × = Absent/Not used

Through the 3-days classroom observation of two physics teachers, it was evident that physics teachers often assess students through oral questioning. Physics teachers usually throw general questions to their students and solicit answers from different students. Teachers comment on students' answers by indicating whether they are right or wrong or make corrections in their submission where necessary. Also, trial question on topics taught are given to students as assignment (Homework). Class exercises and test are occasionally conducted. In grading the trial questions or class exercises completed by students, teachers sometimes allow students to comment on and grade their own work or that of their peers based on laid down scoring rubrics.

Key findings 5:

i. Majority of physics teachers often employ interactive formative assessments such as question and answer technique which usually occur in the form of a dialogue between teachers and students.

ii. Physics teachers rarely allow students the opportunity to grade and comment on their own work and that of their peers when assessing students' progress in physics

4.6 Results from Interview

Students were asked to respond to five interview questions. Presented in Tables 7, 8 and 9 are the interview questions and responses from students during the individual interview and focus group discussion. Presented in Table 7 are the results obtained during students' interview concerning their physics teachers' assessment practices using interview schedule for students to enable the researcher answer research question 2.

Table 7: ***Students' responses to interview questions on Physics teachers' assessment practices***

Interview Questions	Responses
1. Which assessment techniques employed by your physics teacher helps you to better understand physics?	✓ Home works and group work ✓ We write class tests ✓ Giving us lots of trial examples to work on after class ✓ Our teacher asks us questions orally to find out if we understand what he has taught ✓ Our teacher gives us class exercises
2. Which of the assessment techniques do you not enjoy learning physics with?	✓ When the teacher gives us a lot of home work and trial questions to solve, we do not get time to learn other subjects

Field Data, 2021

Key findings 6:

i. Results from the interview revealed that, Physics teachers often use formative assessment technique that has the benefit of providing immediate feedback such as answer and question technique.

ii. Physics teachers most often assess their students using knowledge test and teacher made test in the form of class test and take home assignments.

iii. Physics students revealed that they sometimes spend more time learning physics at the expense of other subjects when their physics teachers give them so much trial questions.

Tables 8 and 9 presents the results obtained during students' interview concerning their physics teachers' pedagogical skills and students' perception of their physics teachers' classroom practices respectively.

Table 8: ***Students' responses to interview questions on Physics teachers' pedagogical skills***

Interview Questions	Responses
3. Which pedagogical skills employed by your physics teacher motivates you to learn and want to further physics at the tertiary level?	✓ Our physics teacher offers help whenever the need arises ✓ logical presentation of lesson and good pace of lesson ✓ using the physics laboratory ✓ giving us lots of trial examples ✓ teaching with real life examples ✓ teaching by demonstration ✓ linking topics taught to daily phenomenon
4. Which other pedagogical skills would you recommend to your physics teacher?	✓ There should be more physics practical ✓ he could use other stuff outside the book to create examples ✓ the class should not be boring and dull but it should be lively. ✓ more use of power point presentation ✓ allow us perform practical often ✓ the use videos for better understanding ✓ going on excursion (sites where physics knowledge is applied)

Field Data, 2021

Key findings 7:

i. According to students, logical presentation of subject matter and good pacing of lessons, learning through demonstration and use of real life examples are some pedagogical skills that motivate them to learn physics.

ii. Physics students love to be taught through demonstration, practical and use of trial examples

iii. Students recommend the use of videos, power point presentation and examples from real life phenomenon in teaching physics.

iv. Physics students want opportunities to see physics knowledge put into Practice for better understanding and appreciation of what they learn in the classroom

Table 9: ***Students' overall perception of their Physics teachers' classroom practices***

Interview Questions	Responses
5i. Which classroom activities and practices of your Physics teacher helps you understand physics?	✓ clarifying answers to questions asked and answered by students ✓ he motivates us to learn outside what he teaches ✓ when he involves us all during the teaching process ✓ explanation of difficult concepts using different approaches ✓ teaching and explaining concepts ✓ his ability to project what we learn ✓ he gives logical explanations ✓ relates topics to situations in real life
5ii. Which classroom activities and practices of your Physics teacher helps	

you enjoy learning Physics?	✓ he makes physics kind of fun ✓ use of computers, projectors, pictures and videos ✓ he makes physics of fun ✓ connecting topics we learn to real life situations ✓ learning with computers and projector.

Field Data, 2021

Key findings 8:

i. Students indicated that they are able to understand physics better when their teachers employ good pedagogical skills such as clarification of answers to questions and explanation of difficult concepts using different approaches.

ii. According to students, the use of ICTs such as computers, projectors, pictures, videos and connecting topics to real life situations of students are classroom practices of Physics teachers that helps students enjoy learning Physics.

Table 10: ***Students' overall perception of their Physics teachers' classroom practices***

Interview Questions	Responses
5iii. Which classroom activities and practices of your Physics teacher helps you perform academically well in Physics?	✓ solving lots of trial questions with us after teaching each topic ✓ often making sure we understand what he is teaches ✓ Solving a lot of examples on each topic taught ✓ he encourages us to learn outside what he teaches ✓ he always ensures we understand what he is teaching
5iv. Which classroom activities and practices of your Physics teacher helps you likely to pursue Physics at the Tertiary (Higher) level?	✓ explaining the relevance of each topic taught ✓ making the subject simple to understand ✓ explaining the relevance of each topic taught
5v. Which classroom activities and practices of your Physics teacher helps you encourage others to pursue Physics?	✓ his constant motivation ✓ he makes it fun ✓ teaching in a simple way for easy understanding

Field Data, 2021

Key findings 9:

i. Students also pointed out that their academic success in physics is influenced by their physics teachers' motivation and ability to ensure students understand what they teach.

ii. Students indicated that if their physics teachers explain the relevance of each topic taught, and make the subject easy to understand, they are likely to pursue it at the tertiary level and also recommend it to others.

CHAPTER FIVE

DISCUSSION OF RESEARCH FINDINGS

5.0 Overview

This chapter comprises discussion of key findings of the study. The discussion of the findings is done by comparing and contrasting the findings in this study with the findings and recommendations of other related studies.

5.1 Demographic Characteristics of Respondents

The findings revealed that, majority 190 (95%) of the respondents are students aged 16 to 21. The results indicate most of these students are in their teen. Also worth noting is the fact that most of these students 163 (81.5%) are males which reveals that there are more males pursuing science (Physics). This finding is evident in most of our second cycle and tertiary institutions where majority of the students studying science and physics related programmes are males. One major reason that can be attributed to this phenomenon is the notion that males thrive more in the science and mathematics related subjects. This is characterised by female underrepresentation and underachievement in science (Bello, 2002; Mari, 2005; Awoniyi, 2000). The details of the demographic information of the respondents are presented in Table 1. In addition to the physics students who answered the questionnaire and responded to the interview questions, two male physics teachers in their early thirty were also observed and the findings presented in Table 5 and 6.

5.2.0 Research Question 1: What are the Pedagogical Skills Employed by Physics Teachers in Teaching at the Senior High School Level?

Triangulation is a commonly used strategy by researchers whereby multiple methods or sources of data are used to address the same question. Several instruments (questionnaire, classroom observation checklist, interview schedule and checklist list for inspecting students' notebooks and exercise books) were employed in gathering sufficient data to enable the researcher provide answers to the research question one. Triangulation is very important because it is a primary way that qualitative researchers ensure the trustworthiness (i.e. validity and reliability) of their data (Greene, 2007; Hesse-Biber & Leavy, 2005, 2011). The results obtained from the data collected yielded key findings one, four and seven which answers the research question one. Below is a discussion of the key findings.

5.2.1 Pedagogical skills employed in teaching physics.

Instructional strategy adopted by the teacher is known to be one of the most significant factors that affect students' achievement. (Okoronka & Wada, 2014). It has also been established in previous studies that the best teacher is one that carefully utilises a range of pedagogical approaches to ensure understanding and effective student's learning (Conn, 2014; Kremer & Holla, 2009). However, findings in this study revealed that physics teachers do not often employ certain important pedagogical skills. According to most of the physics students (67.5%), their physics teachers do not often respond appropriately to their wrong answers and misconceptions. A number of physics students (48%) also raised concerns about their physics teachers' inability to often link what they teach to their daily life occurrences. Contrary to findings from students (through the use of questionnaire) indicating that their physics teachers do not often employ certain pedagogical skills, evidence from

observation indicates that physics teachers possess and exhibited sufficient knowledge on diverse pedagogical skills. It was confirmed through observation of classroom practices that physics teachers exhibited good pedagogical skills in their ability of properly defining unfamiliar terms, concepts and principles and explaining major or minor points with clarity. These findings indicate that though physics teachers possess sufficient knowledge on diverse pedagogical skills, they do not often use them to the benefit of students. The dire consequences are that students will have less understanding of most physics concepts leading to ineffective students' learning and decrease in students' motivation to study physics. Buabeng, Ossei-Anto and Ampiah (2014) suggest physics teachers should be exposed to efficient pedagogies of teaching and presenting information to learners through professional development programmes. The constant exposure will draw physics teachers' attention to the importance of these pedagogies and the need to often use them in teaching. It is evident from findings in this study that majority of physics teachers did not identify and address their students' wrong answers and misconceptions. They also do not often link what they teach to the daily life occurrences of their students. The negative effects of this is manifested in physics students' lack of appreciation for the subject.

However, during interview, students who are the direct recipient of knowledge from teachers pointed out that they enjoy learning physics when teachers employ ICTs such as computer, projectors, laptops, videos and pictures. It is high time teachers took advantage of these ICTs as it has the potential of helping teachers explain complex concepts whiles making learning fun as well. Similarly, Nguyen, Williams and Nguyen (2012) listed LCD projector, Computer, Speakers and over-head Projector as some ICTs that can help ensure that the teaching of certain complex concepts can easily and effectively be taught and demonstrated for better

understanding. These ICTs together with internet can also be used to show students the various practical uses or applications of the physics concepts they learn in the classroom. When physics teachers often use real life examples that students can relate to in teaching, it inspires students to appreciate and attach importance to what they learn and not see physics concepts as abstract and difficult.

Physics teachers also did not lay much emphasis on cooperative learning during teaching. Through cooperative learning, students have the opportunity to share ideas and learn from each other. This finding confirms the existence and practice of traditional approaches to teaching physics which often fail to promote adequate student understanding of physics concepts (Angell et al., 2004; Hackling et al., 2001; Masika, 2011; Mulhall & Gunstone, 2008, 2012). As suggests by McDermott (2001) that the focus of physics teaching should be on the students as learners. He further maintained that effective teaching should include close contact with students where teachers observed the struggles of students as they tried to understand important concepts and principles.

Findings from interview suggests that physics students are constantly longing for opportunities that will enable them better understand complex concepts and experience the practical use of the physics concepts and principles they study in the classroom. All these, according to students, could be achieved through logical presentation of lessons at a good pace, teacher demonstration, laboratory practical and visiting of industries where physics concepts, ideas and principles are applied. All these activities will make learning of physics interesting to students help them to better understand and appreciate what they learn in the classroom.

5.3.0 Research Question 2: What Types of Assessment are used by Teachers in the Teaching of Physics at the Senior High School?

To enable the researcher effectively provide answers to the research question two, multiple instruments (questionnaire, classroom observation checklist, interview schedule and checklist list for inspecting students' notebooks and exercise books) were employed to collect sufficient data. The results obtained from the data collected yielded key findings two, five and six which answers the research question. Below is a discussion of the key findings.

5.3.1 Types of assessment used by physics teachers

Mikre (2020) laid emphasis on the need to gather a variety of information and determine the degree to which students have attained the learning targets intended in the curriculum. This study discloses that physics teachers make use of a variety of formative assessment techniques to enable them understand their students and monitor instruction. Findings reveal that physics teachers most often employ interactive formative assessments through questioning in the form of dialogue as well as class exercise and class test to determine if students have attained the learning targets intended in the curriculum. In a related study, tutors agreed that interactive formative assessments promoted learning outcomes through questioning in a form of dialogue (Bekoe, Eshun & Bordoh, 2013) and also has the benefit of providing immediate feedback to improve teaching and learning (Akyina & Oduro-Okyireh, 2019). Findings in this study also indicated that knowledge test and teacher made test to be completed by students inside or outside the classroom are commonly used formative assessment employed by their physics teachers. In a related study, Akyina and Oduro-Okyireh (2019) also found that the use of class exercises was more prominent among

the formative assessment techniques used. Classroom test and assignment were sampled as assessment methods often used by teachers of secondary schools in Osun State, Nigeria (Faleye & Adefisoye, 2016).

Contrary to the findings of Plybour (2015), which divulges that peer assessment was regularly used in formative mode at the beginning of lessons, especially during classroom discussion of homework. Findings in this current study revealed that physics teachers rarely allow students the opportunity to grade and comment on their own work and that of their peers when assessing students' progress in physics. Despite the relevance of Peer and self-assessment to provide learners with the opportunity to take responsibility for analysing, monitoring and evaluating aspects of both the learning process and product of their peers (Bekoe, Eshun, Bordoh, 2013), physics teachers rarely use them. Concerns has however been raised about the quality of peer feedback and comments (Plybour, 2015). The quality of peer feedback could possibly be a deterring factor that could explain why physics teachers often resort to the use other modes of assessment. Much time is needed for teachers to prepare students to be able to assess their own work and that of their peers because there is a need for more detailed criteria to be developed by the instructor to guide the student effectively carry out the assessment process.

It was also evident in this current study through observation of teachers' classroom practices and the exercise books of physics students that oral questioning and answer, giving of home work and class exercise are among the major formative assessment techniques often used by physics teachers. A similar observation was made in a classroom setting that tutors asked questions in open discussion, use questions and answers to introduce their lesson and students were called to summarise what they learnt after the lesson (Bekoe, Eshun & Bordoh, 2013). Bekoe et. al.

concluded that interactive formative assessments through questioning in the form of dialogue promotes learning outcomes. The practice of oral questioning of students before lesson begins, during or at the end of lessons coupled with the use of other classroom formative assessment techniques such as giving class exercises and test as well as giving assignments has the benefit of providing immediate feedback to improve teaching and learning when it is used appropriately and effectively (Akyina & Oduro-Okyireh, 2019) hence it is often used by physics teachers and teachers of other subjects as well. However, findings from interview with students revealed that their physics teachers sometimes give them lots of trial examples and assignments which tend to reduce the time needed to study other subjects which are equally important. There is therefore the need for teachers to use these assessment techniques appropriately to the benefit of students.

5.4.0 Research Question 3: What is the Perception of Students of their Physics Teachers' Classroom Practices?

To enable the researcher effectively provide answers to the research question three, two instruments (questionnaire and interview schedule) were employed to collect sufficient data. The results obtained from the data collected yielded key findings three, eight and nine which answers the research question. Below is a discussion of the key findings.

5.4.1 Perception of students of their physics teachers' teaching

A greater proportion of the physics students held a negative perception about their physics teachers' classroom practices. Findings from the study revealed that physics teachers are not showing interest in their students' academic progress and are

not always teaching in a way that helps students to learn effectively. Physics students also expressed negative opinion with regard to their physics teachers' knowledge of the subject matter. Generally, students expressed negative opinion with regard to their physics teachers' pedagogical content knowledge and motivation of students to study physics. Consistent with this finding, is that of Jasia, Nurul and Sarif, (2018). In a similar study they carried out with the purpose of examining the perception of undergraduate students about their teachers' teaching, it was found that all the students did not feel good at some of their teachers' behaviour and attitude when they teach. Perceptions of students according to Ampadu (2012) are shaped by the shared events in the classroom. Ahmed and Aziz further noted that students' perception of their teacher's teaching contribute very much in improving the teaching and learning of the subject as it provides valuable suggestions and directions for their teacher's future improvement (Ahmed & Aziz, 2009). Negative perceptions of students have equally negative influence on their performance in Physics courses as confirmed by Bamidele (2001) who reported that students' lack of interest in physics is due to their perception that physics is a difficult subject. It is therefore a wake-up call for physics teachers not to underestimate their teaching style, attitude and behaviour in class as this could go a long way to influence students' perception and affect their academic performance. (Ampadu, 2012)

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Summary of the Study

The primary purpose of teaching at any level of education is to bring a fundamental change in the learner (Tebabal & Kahssay, 2011). To effectively help bring about this desirable change, teachers apply in the classroom, appropriate teaching methods that best suit specific objectives. To ensure that this desirable change is effectively achieved, this study was carried out to find out the classroom practices of physics teachers and students' perception of their teachers' classroom practices.

A descriptive cross-sectional survey was adopted where the researcher collected data at one point in time from 200 senior high school physics students and two physics teachers in the Hohoe municipality. Questionnaire, observation schedule and interview guide were the main research instruments used to gather data for the study.

SPSS was used to analyse the data gathered. The data was edited, coded, presented and analysed using statistical tools such as frequency, percentages, mean and standard deviation.

6.1 Summary of Key Findings

A number of findings were revealed through the studies but significant and worth noting among them are summarised as follows:

1. According to most of the physics students (67.5%), their physics teachers do not often respond appropriately to their wrong answers and misconceptions. A number of physics students (48%) also raised concerns about their physics teachers' not often linking what they teach to their daily life occurrences.

2. Contrary to findings from students (through the use of questionnaire) indicating that their physics teachers do not often employ certain pedagogical skills, evidence from observation indicates that physics teachers possess and exhibited sufficient knowledge on diverse pedagogical skills.
3. Physics students desire to be taught through demonstration, good pacing and logical presentation of subject matter, use good examples from the real world and the use of ICTs such as computers, projectors, pictures and videos. According to the students, these practices motivate, help them understand and effectively learn physics.
4. Physics teachers often use interactive formative assessments such as oral question and answer technique that usually occur in the form of a dialogue between teachers and students and has the benefit of providing immediate feedback.
5. Knowledge test and teacher made test to be completed inside or outside the classroom by students are commonly used formative assessment practices of physics teachers.
6. Formative assessment techniques such as self and peer assessment which enables students assess their own work or that of their peers using criteria developed by the instructor are rarely used by physics teachers.
7. Most physics students also pointed out that their interest and academic success in physics is influenced by their physics teachers' motivation, interest in their academic progress and ability to ensure students understand what they teach.
8. Majority of students held a negative perception about their physics teachers' interest in their academic progress and inability to regularly motivate them to study physics.

6.2 Conclusion

The academic performance of Ghanaian students in physics in senior high school has been found to be generally and consistently poor over the years (Orleans, 2007). However, it is believed the teacher-students interactions that take place in the classroom could serve as an effective means of knowledge acquisition by students (Borich, 2007; Fishburne & Hickson, 2001). The existence of positive teacher-students' interactions influenced by teachers' classroom practices enables students easily inform teachers of their difficulties in physics. This results in effective knowledge acquisition and improved academic performance (Adeyemo, 2010). This study was therefore carried out to ascertain the classroom practices of physics teachers and how these practices of physics teachers contribute to their students' perception and academic performance.

The results of this study has revealed students concerns about their physics teachers' not often applying some important pedagogical skills such as linking what they teach to their students' daily life occurrences and not often responding appropriately to students' wrong answers and misconceptions. However, evidence from observation indicates that physics teachers possess and exhibited sufficient knowledge on diverse pedagogical skills. These findings should therefore draw physics teachers' attention to the frequency with which they apply these important pedagogical skills in the classroom.

The frequent use of interactive formative assessments such as oral question and answer technique that usually occur in the form of a dialogue between teachers and students is a step in the right direction and should be encouraged. The attention of physics teachers should however be drawn to other equally important assessment technique such as self and peer assessment. These assessment techniques give students the opportunity to learn the criteria for high-quality performance and

experience a willingness to apply those criteria. They also enhance students' willingness and ability to become active members of a group of learners (Papinczak, Young & Groves, 2007; Herrera et al., 2007).

Finally, students have generally expressed negative perception about their physics teachers' classroom practices. Perceptions of students according to Ampadu (2012) are shaped by the shared events in the classroom. Ahmed and Aziz further noted that students' perception of their teacher's teaching contribute very much in improving the teaching and learning of the subject as it provides valuable suggestions and directions for their teacher's future improvement (Ahmed & Aziz, 2009). Negative perceptions of students have equally negative influence on their performance in Physics courses as confirmed by Bamidele (2001) who reported that students' lack of interest in physics is due to their perception that physics is a difficult subject. It is therefore a wake-up call for physics teachers not to underestimate their teaching style, attitude and behaviour in class as this could go a long way to influence students' perception and affect their academic performance. (Ampadu, 2012)

6.3 Recommendations

Based on the key findings and the conclusions drawn from the study, the researcher's would like to make the following recommendations.

1. Physics teachers should carefully pay attention to and often address their students' wrong answers and misconceptions.
2. Physics teachers should try their possible best to make learning of physics interesting by making students appreciate the importance of what they study, show interest in the overall success of their students and often encourage students to study physics.

3. Physics topics learnt should be linked to daily life activities of students and physics teachers should often cite examples from students' daily life while teaching.
4. The use of ICTs such as computers, projectors, pictures and videos in teaching have the potential of helping teachers explain complex concepts, motivate students to learn and making teaching easier and more effective. It should therefore be encouraged among physics teachers.

6.4 Suggestions for Further Study

Further studies should:

1. be extended to other schools in the country as a whole to ascertain the classroom practices of physics teachers nationwide in order for a better conclusion to be drawn.
2. ensure that data is collected at different times across the nation to confirm the consistency of the information provided by respondents for effective generalisation.
3. include critical observation of more physics teachers' teaching over a longer period of time to ascertain the real situation on the ground.
4. also be extended to other subject areas. The teaching of other subjects especially chemistry, biology, integrated science and mathematics should also be examined.

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APPENDIX A

QUESTIONNAIRE FOR STUDENTS

Questionnaire on physics teachers' classroom practices and students' perceptions of their practices

This study is conducted to investigate physics teachers' classroom practices and their students' perception of their classroom practices. The purpose of this questionnaire is to obtain information on physics teachers' classroom practices and to find out about students' perception of their physics teachers' classroom practices. Information obtained using this questionnaire is purely for academic purposes. You are therefore assured that any information you provide will be kept strictly confidential.

INSTRUCTION

Please tick (√) the responses you find most appropriate and write where applicable.

Key: Always (Al), Often (O), Never (N), Sometimes (S), Rarely (R).

SECTION A

Student's Background Information

Sex: Male [ ] Female [ ]

Age: 13-15 years [ ] 16-18 years [ ] 19-21 years [ ] Above 22 [ ]

Class: Form 1 [ ] Form 2 [ ] Form 3 [ ]

SECTION B

Pedagogical skills employed in the teaching of physics

Key: Always (Al), Often (O), Never (N), Sometimes (S), Rarely (R).

Items; My Physics Teacher:	AL	O	N	S	R
1. makes physics lesson interesting for us by citing lots of examples from daily life					
2. engages all of us in physics activities during each lessons					
3. goes very fast when teaching so I do not follow the lesson					
4. speaks clearly and loudly so am able to get all that goes on during lessons					
5. correct our mistakes when we answer questions wrongly during lessons.					
6. put us in groups and asks us to teach one another					
7. gives exercises which are marked and returned to us on time					

SECTION C

Types of assessments used by senior high school physics teachers in teaching physics.

How often does your Physics teacher use these assessment techniques for teaching?

Assessment techniques	**Always**	**Often**	**Never**	**Sometimes**	**Rarely**
8. Oral question and answer					
9. Home work					
10. Class exercise/class test					
11. Peer-assessment					
12. Self-assessment					

SECTION D

Students' perception of their physics teachers' classroom practices

Key: Always (Al) Often (O) Never (N) Sometimes (S) Rarely (R)

Items; My Physics Teacher	AL	O	N	S	R
13. teaches in a way that helps me to learn effectively					
14. teaches in a way that helps me to understand that, things we learn in physics are important					
15. gives clear explanation and directions on classroom activities					
16. shows interest in my academic progress and success in life					
17. teaching has made me more interested in studying physics					
18. encourages me enough to study physics					
19. uses the appropriate teaching-learning materials and assessment techniques that helps me understand physics better.					

Source: Adapted from the intern record book of the University of Education, Winneba and Teaching practice assessment form A of the Centre for teacher professional development, University of Cape Coast.

APPENDIX B

INTERVIEW SCHEDULE FOR STUDENTS

The purpose of the interview is to acquire further and detailed information that cannot easily be obtained using questionnaire regarding Physics teachers' classroom practices and their student's perception of their Physics teachers' practices. The interview questions will give students the opportunity to freely express themselves and provide detailed information with regards to the classroom practices of their physics teacher.

Pedagogical skills employed by physics

1. Which pedagogical skills employed by your physics teacher motivate you to learn physics and make you want to further physics at the tertiary level?
2. Which other pedagogical skills would you recommend to your physics teacher?

Assessment techniques employed by the Physics teacher

3. What are some of the assessment techniques employed by your Physics teacher helps you to understand and enjoy learning Physics?
4. Which of the assessment techniques do you not enjoy learning Physics with?

Students Overall perception of his/her physics Teacher's classroom Practices

5. Which classroom activities and practices of your Physics teacher helps you
   i. understand physics?
   ii. enjoy learning Physics?
   iii. perform academically well in Physics?
   iv. likely to pursue Physics at the Tertiary (Higher) level?
   v. encourage others to pursue Physics?

APPENDIX C

CLASSROOM OBSERVATION CHECKLIST

School: **Class:** **Date:**

Respond to each statement (1-8) using the following scale:

5 = Very Good 4 = Good 3 = Satisfactory 2 = Unsatisfactory

1= Poor 0 = Not observed

PEDAGOGICAL SKILLS USED BY THE PHYSICS TEACHER	0	1	2	3	4	5
1. Explain major/minor points with clarity.						
2. Presents lesson systematically						
3. Use good examples to clarify points.						
4. Vary explanations for complex or difficult concepts.						
5. Emphasize important points.						
6. Relates lesson to students' prior knowledge and daily life experiences						
7. Encourages collaborative and cooperative learning						
8. Ask relevant questions to monitor student understanding and actively encourage student questions						

ASSESSMENT TECHNIQUES USED BY PHYSICS TEACHERS	Used	Not used
9. Oral questioning and answer		
10. Home work		
11. Class exercise/class test		
12. Observation of students' participation and progress		
13. Peer-assessment		
14. Self-assessment		

Source: Adapted from the intern record book of the University of Education, Winneba and Teaching practice assessment form A of the Centre for teacher professional development, University of Cape Coast.

APPENDIX D

CHECKLIST FOR INSPECTING STUDENTS' NOTEBOOKS AND EXERCISE BOOKS

ASSESSMENT TECHNIQUES USED BY PHYSICS TEACHERS	Tally	Frequency
1. Home work		
2. Class exercise/class test		
3. Project work		
4. Group work		
5. Use good examples to clarify important points in notes		
6. Vary explanations for complex or difficult concepts.		
7. Gives alternative solutions to questions		
8. Summaries definitions of terms and concept for easy understanding		

Source: Adapted from the intern record book of the University of Education, Winneba and Teaching practice assessment form A of the Centre for teacher professional development, University of Cape Coast.

APPENDIX E

The table below is a summary of the research question the various items which makes up each instrument seeks to address

Research Instruments	**Research question 1**	**Research question 2**	**Research question 3**
Questionnaire for students	Items 1-7	Items 8 -12	Items 13-19
Classroom observation checklist	Items 1- 8	Items 9-14	
Interview schedule for students	Items 1-2	Items 3- 4	Item 5
Checklist for inspecting students' notebooks and exercise books	Items 5- 8	Items 1- 4	

Reliability Statistics

Cronbach's Alpha	N of Items
.806	21