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The impact of physics practical on the teaching and learning of senior secondary schools physics in selected school in Bo City

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Abstract
This study is a comprehensive research on the Impact of Physics Practical's on the Teaching and Learning of Senior Secondary Schools Physics in Selected School in Bo City Physics subject is an elective subject where students in the science stream pursue the subject during their upper secondary school. This is despite the fundamental role Physics as a science subject plays in the contribution of innovations and developments teachers tend to avoid the practical work in the laboratory which they consider waste of time and they do not understand the importance of laboratory experiments.
Specifically, the study was set to achieve six objectives namely; To find out the Demographic Characteristic of respondents, To identify the knowledge of teachers and students on physics practical, To examine the attitudes of student and teachers towards physics Practicals, To examine the engagement of teachers and students in physics Practicals, To determine the effectiveness of teaching physics and To identify the factors affecting the teaching and learning of physics Practical. The research was carried out by six selected senior Secondary Schools in Bo City. The design of the research will adopt a descriptive survey. The population of the study consists of 676 pupils and twelve (12) teachers in the senior secondary school that offer and teacher teaching physics respectively. Out of which 169 students and all the twelve teachers were selected through a simple random sampling.
Data was collected using questionnaires .the a questionnaire comprises of six sections. Each of the section dealt with one objective. The analysis of the data collected was done using SPSS version 25 and Excel.
From the result of the research many problems were unfolded. These problems that were unfolded are: the teachers and student are not effective engage in Practicals and there are factors affecting students and teacher in the effective teaching and learning of physics practical The recommendations made will mitigate the problem.

Keywords: physics practical, selected school, subject

1. Introduction

In the world, physics subject is an elective subject where students in the science stream pursue the subject during their upper secondary school. According to Mahzan Bin Bakar, the Director of Curriculum Development Centre in Malaysia, physics curriculum targets to produce active learners where students have chances to partake in scientific investigation via hands-on activities and experimentations. One of the aims of the physics curriculum for secondary schools in Malaysia is to give students the knowledge and skills in science and technology. Therefore, students can solve problems and make decisions based on scientific attitudes and noble values in everyday life (Curriculum Development Centre Malaysia, 2005a). Physics is a difficult subject to learn (Veronika, Johannes, & G. Budijanto, 2017). Students always have this kind of perceptions and low confidence which lead to fewer students to take up physics at school (Fatin, Salleh, Bilal, & Salmiza, 2012).

According to Dolin's study (as cited in Angell et al., 2004), physics needs students to learn many types of representation such as experiments, graphs and mathematical symbols. Students would have to understand and learn the transformation of all these representations. Other factors that hinder students to study physics are because they are not interested in the subject, boring, difficult and irrelevant to daily life (Hirschfeld, 2012; Williams, Stanisstreet, Spall, Boyes, & Dickson, 2003). One of the reasons is because teachers have not self-confidence enough to teach physics using practical work where they prefer to use traditional teaching method like chalk-and-talk. Some schools also have no proper laboratories to work on experiments (Kibirige & Tsamago, 2013). Besides, lack of laboratory facilities and less of exposure to practical instruction are also the factors lead to the poor achievement in physics at school (Daramola, as cited, in Musasia, Abacha, & Biyoyo, 2012). Teachers are not exposed to science process skills to carry out activities in the class room (Rose, Sattar, Azlin, Zarina, & Lyndon, 2013). Therefore, teachers tend to avoid the practical work in the laboratory which they consider waste of time and they do not understand the importance of laboratory experiments (El-rabadi, 2013). Theoretical knowledge is always supported by the practical knowledge which helps students to expand their manipulative skills and scientific attitudes (Josiah, 2013). Therefore, practical work needs to be reinforced during physics class to change students' perception towards physics and improve their performance.

Physics is the basis of technological development and as one of the highlights of the senior secondary School curriculum which determines the enrolment of students into professional courses in tertiary educational institutions cannot be studied without practical work (Manso 2020). Practical activities are the bedrocks of all pure sciences of which physics is not an exception and learning physics without practical work will only promote rote learning; which enables ideas and concepts to be retained for a very short time (Kabia 2020). This simply means that effective practical activities in physics enhance learners to build a bridge between what they can see, hear and handle. Virtually, no amounts of meaningful principles and concepts in physics can be taught without adequate support of practical. Practical activities help learners to retain knowledge for a very long time (Samuel et al 2018).

Prior to the 6-3-3-4 educational system in our country, it can be attested that students offering science in schools like Government secondary School Bo, Maurilio, Prince of Wales, The Sierra Leone Grammar school, under the auspices of our colonial masters where able to manage societal problems that require the application of science and technology. Physics practical lessons should be therefore treated as student- cantered, competence based and activity oriented in order to translate the goals of the subject. Many a time teachers are highly focused on completing the syllabus rather than considering the needs of the subject towards the learner.

It is against this background that an Assessment on the Impact of Physics Practical's on the Teaching and Learning of Senior Secondary Schools Physics in Selected School in Bo City

1.1. Statement of the Problem

An investigation into the ways physics is handled in most of our secondary schools signifies that students were made to merely see physics as a collection of rules. Proper conduct and involvement of Students in physics practical has become less important and as result of that learners have become passive listeners in the laboratory where they only watch teachers dispensing ideas theoretically or even in their demonstration in experiments (Anele, 2011). Other assumed problems may include that students are not encouraged to consider practical Work useful for the development of scientific skills and attitudes. Lack of equipment and facilities and their inadequacy which hinder the effectiveness of learning physics practical in schools. It is against this background that an Assessment on the Impact of Physics Practical's on the Teaching and Learning of Senior Secondary Schools Physics in Selected School in Bo City.

1.2. Aim and Objectives of the Study

The aim of this study is an Assessment on the Impact of Physics Practicals on the Teaching and Learning of Senior Secondary Schools Physics in Selected School in Bo City.

The following are specific objectives of this study:

1. To find out the Demographic Characteristic of respondents
2. To identify the knowledge of teachers and students on physics practical
3. To examine the attitudes of student and teachers towards physics Practicals
4. To examine the engagement of teachers and students in physics Practicals
5. To determine the effectiveness of teaching physics Practicals
6. To identify the factors affecting the teaching and learning of physics Practical

1.3. Research Questions

1. What are the Demographic Characteristics of respondents?
2. What knowledge do teachers and students have on physics practical?
3. What are the attitudes of student and teachers towards physics Practicals?
4. Are teachers and students engaged in physics practical?
5. How effective is the teaching of physics practical?
6. What are the factors affecting the effective teaching and learning of physics practical's?

1.4. Hypothesis

H_{01}: Setting up the apparatus has a direct relationship in performing the experiments

H_{02}:

1.5. Significance of the Study

In the pursuit of investigating on the Impact of Physics Practical's on the Teaching and Learning of Senior Secondary Schools Physics in Selected Schools in Bo City, the outcome of this research may possibly help in enhancing successful teaching of physics subjects by teachers, increasing student's involvement and performance of practical work in physics.

Furthermore, the findings may hence be used to increase student's interest towards the conducting of physics practical. It is equally hope that teachers would find all possible means of making physics practical periods more interesting rather than being boring. Finally, the study will also provide the basis for further findings of research in the area.

1.6 Delimitation of the Study

This piece of work is geared towards an Assessment on the Impact of Physics Practical's on the Teaching and Learning of Senior Secondary Schools Physics in Selected School in Bo City. The study was limited to Bo town and no other town in the Bo District and only involved the SSS two and three students who had already made the choice to take physics and teachers teaching physics at this levels

1.7 Limitations of the Study

Bo city is a large city and therefore due to the time frame given by the university it was not possible for the researcher to cover the whole of the city since work of this nature will require time and for comprehensive report on the subject matter, more time must be given.

The researcher was not in a financial position to cover the whole city, because financial expenditure especially to travel to the schools for pre survey, observation, administering the questionnaires and the cost of logistic etc therefore few schools were sampled to represent Bo city public and private schools.

Research work of this nature in Bo City presents numerous challenges which constrain study of this type. Such challenges basically center primarily on access to information Accessing Physics teachers will be problematic in sense that they will be most time engaging in other schools since they are in shortage to enhance meat.

Since the state of infrastructure in the city was not good the researcher sampled schools near the main road therefore the study was not balanced sectionally.

With all these difficulties, the study will be carried out and final findings will be reached through hard work

As a result of the limitation, the study will be limited just to six Senior Secondary Schools in Bo City. These schools are:

1. Bo Government Secondary School
2. Queen of the Rosary Secondary School
3. Christ The King College
4. Ahmadiyya Senior Secondary School Bo
5. SOS Hermann Gmeiner International School Bo
6. Allawalie International Academy

1.8. Definition of Terms

1.8.1 Physics Practicals: These are activates conducted with the aid of physics apparatus to either discover fact or verify fact in a class or room or laboraties

1.8.2 Practical Work: It is work in which students interact with materials or With secondary sources of data to observe an understand the material world.

1.8.3 Physics Teacher: This is a teacher that teaches physics

1.9.4. Students: This referred to pupils in the SSS III in the senior secondary schools that are in the science faculty

2. Literature Review

2.1 Introduction

According to Science Community Representing Education (SCORE), practical work means 'a "hands-on" learning experience which prompts thinking about the world in which we live (Score, 2008). Besides, practical work can also be defined as "learning experience in which students interact with materials or with secondary sources of data to observe and understand the natural world" (Lunetta, Hofstein, & Clough, 2007). Experimental work and scientific investigations are another ways to be called as practical work (Ramnarain, 2011). Students will learn the science concept by doing experiments in the Laboratory which is a different approach from "Chalk and Talk" method (Bruner, 1990). Therefore, laboratory experiment is one of the examples of practical work in secondary school level (Musasia et al., 2012). The traditional teaching approach is defined as teaching is entirely depend on textbooks where the teacher teaches the content and students just sit, read, and do assignments and taking notes (Ates & Eryilmaz, 2011). Traditional teaching classes look like a one-person show where usually controlled by direct and one-party instruction (Abida & Muhammad, 2012). At the same time, students are just unresponsively receiving the information from the teachers (Liu, 2014) and without questioning the teacher (Stofflett, 1999). According to a report done in Malaysia 1996 by Federal Schools Inspectorate (Jemaah Nazir Sekolah Persekutuan, as cited in Salmiza & Afik, 2012), teachers in Malaysia mostly were knowledgeable, familiar with the teaching contents and used various kind of techniques in teaching, yet, the teaching method was still teacher-centred. This method of teaching is still going on after 15 years of the report has been published where the teaching practices is still a one way, teacher-centred which makes students behave passively in the classroom (Salmiza & Afik, 2012). 'Hands-on' methods are suggested in constructivist-based learning (Ng & Nguyen, 2006). Another alternative constructivist learning approach is the use of practical work in science teaching and learning. By having real-life phenomena, students are given the opportunities to evaluate and measure their views and to improve the understandings before the learning process (Ng & Nguyen, 2006). Practical work creates exceptional learning surrounding that help student to construct their knowledge, enhance logical, inquiry and psychomotor skills (Mashita, Norita, & Zurida, 2009). Besides, practical work offers an interactive experience to the students where they can broaden the scope of constructivist learning (Umar, Ubramaniam, & Ukherjee, 2005). The education system in Malaysia is still very exam-oriented which focuses on examination results and marks (Sharifah Fauziah, Farah, & Ismin Izwani, 2012). Malaysian teachers are also unfamiliar to apply constructivism approach in teaching. Therefore, teachers will be more to teacher-centred rather than student-centred and constructivism approach is unachievable (Arlina & Melor, 2014). It is believed that by having practical work, students' knowledge can be expanded to understand the real world (Millar, 2004). According to Ozdener's study (as cited in Tüysüz, 2010), we know that students can gain knowledge of personal observation and involvement in practical work. Teaching objectives can be achieved easily by doing practical work especially in teaching physics (El-rabadi, 2013). Furthermore, first-hand knowledge of the physics concept will be generated where students can understand the abstract ideas which are difficult to explain during the class (Osborne, 2002). Students' understanding of theories and models can also be developed (Millar & Abrahams, 2009). According to Inal's study (as cited in Musasia et al., 2012), students are faster to understand the physics concepts when they test the experiment by themselves as they can touch the materials and apparatus which make them believe in the experiment.

According to Abraham and Millar (2008), preferred to use the term practical work rather than laboratory work this is because they claimed that science activities are not characterized by the location but by the activities of students when doing school science. Millar further reaffirmed that science teaching naturally involves more than asserting facts. It includes showing learners how things happen and putting them into situations where they can observe for themselves.

Practical work can be regarded as any learning activity in science that encompasses learning by experience (Hodson, 1998). This is most understood when students have first-hand experience in seeing, feeling and handling objects and organisms for themselves.

Physics is an experimental science and the history of science reveals the fact that most of the notable discoveries in science have been made in laboratory. Seeing experiments being performed i.e., demonstrating experiments are important for understanding the principles of Science.

In 2009,the UK based science Community Representing Education (SCORE), defined practical work as any science teaching and learning activities that involve students working individually or in small groups, manipulating or observing real objects and materials as opposed to the virtual world. Woodley (2009) defined practical work as hands-on learning experience that stimulates thinking about the natural world. He further identified possible practical work as being of two kinds.

1. Core activities, investigations, laboratory procedures and techniques and field work, ball of which support the development of practical skills and help to shape students' understanding of scientific concepts and phenomena.
2. Directly related activities which include: teachers' demonstration, the experiencing of phenomena, designing and planning investigations and are either a key component of an investigation or provide valuable first-hand experiences for students. Gotta and Duggan (1995) emphasizes that several attempts have been made to Classify the kinds of practical in order to define their respective roles. Gott et.al. (1998) summarize the types of practical work into five (5) categories.

Types of Practical Work	**Aims of Practical Work**
Skills	To acquire a particular skill
Observation	To provide opportunities for pupils to used their conceptual framework in relating real objects and events to scientific ideas
Enquiry	To discover or acquired a concept, law or principle
Illustration	To prove or verify a particular concept, law or principle
Investigation	To provide opportunities for pupils to used concept, cognitive process and skills to solve problems

However, performing experiments by one's own hand is far more important because it involves learning by doing. According to S.E.B. Nonie and S.M. Kamara (2006), defined physics as an experimental science in which careful observations or measurements of a variety of physical parameters are involved. Controlled observations or experiments consist of measuring and recording data followed by analysis, finally a conclusion is drawn on the value of a physical quantity or the behavior of a physical phenomenon. Physical laws are derived from the basis of our understanding of the nature of the physical world around us. As a result, laboratory work is considered as an integral part in the study of all physics and Science programs.

2.2. Knowledge of Teachers and Students on physics Practicals

Practical knowledge according to James (2000) refers to that knowledge that is connected with reality rather than ideas and theories. According to Mankilik (2011) cited that practical approach is any teaching and learning activity which involves at some points the students in observing or manipulating real objects and materials. The term practical is preferred to laboratory work because location is not a salient feature in describing this kind of activity since observation and manipulation of objects can as well take place in an out of school setting such as learners' home. For instance, boiling and freezing of water, switching of light, Ac, Tv, Radio, the looking of mirrors and many more.

According to Gotta and Duggan view practical work as an activity that allows learners to learn with understanding. With practical work, learners understand better what they have seen rather than what they were taught theoretically. During practical work learners hold and touch the equipment themselves and as such learn by doing. The value of practical work has long been recognized at the secondary school level. Many teachers acknowledged the value of learning by doing rather than just being shown or told Driver and Braund, (2002). If students can be allowed to do practical work in physics, then this could help them understand the content, because students learn something better by doing. They will remember something better that has done with their own hands. This was further emphasized by Hodson (2002) who said that practical work is an essential component of science teaching. It is therefore advisable that students should be prepared with mastery of the skills required for practical work so that they will be ready for assessment. Hodson (2002) further added that in practical work the candidate performs certain activities in order to discover something as yet unknown, to test a hypothesis or to check an already known fact.

A large proportion of both primary and secondary pupils thought that practical work would contribute positively to general learning in science. They believe that practical work provides a carefully independent experience that supports learning. By doing practical work in science at school, students can find things out themselves rather than the teacher telling them (Krathwohl, 1998).This statement by Krathwohl (1998) is true. From the researcher's experience, usually when it is time for practical work, most students are happy and then usually pays more attention than the normal lecture lesson.

In other words, students find it as fun when doing practical work because they discover things for themselves. Leach and Paulseen (1998) stated that practical work with real objects and materials help teachers and learners to communicate information and ideas about the natural world and also provide opportunities to develop students' understanding of the scientific enquiry.

Practical skills in science education are important in their own right. Practical work is useful and essential for the teaching of science in schools to become scientists or technicians and is helpful in assisting concept learning, development of attitudes and interests of learners in science. Students can construct knowledge and skills through their own experience (Windschitl, 2002) and they can construct an accurate representation of the real world (Doolittle & Camp, 1999). The science laboratory environment or setting is a major path for the students to be involved actively and to perform activities, construct new knowledge-sometimes modify the previous knowledge- onto their existing mental framework for meaningful learning to take place (Huitt, 2003; Sherman, 1995).

However, the concept of practical work may be extended to include the need of experience and even a student exercise involving a pencil, paper and calculations based on real examples. Practical work may be performed in the laboratory, but clearly practical activities are confined to the laboratory alone. In that light, physics practical should be treated under

1. Laboratory activities, experiments and demonstration. In a review of the literature on the place of practical work, Schulman and Tamir (1373,p.343) proposed a classification of goals for laboratory instruction in science education as to:
2. Arouse and maintain interest, attitudes, satisfaction, open mindedness and curiosity in science.
3. Develop creative thinking and problem-solving ability.
4. Promote aspects of scientific thinking and the scientific method e.g., formulating hypotheses and making assumptions.
5. Develop conceptual understanding and intellectual ability.
6. Develop practical abilities, for e.g., designing and executing investigations, observations, recording data and analyzing and interpreting data.

In teaching Physics, experimental work is an integral component in giving the starting point of knowledge formation and conceptualization. Koponen & Mantyla (2006) propose an educationally oriented reconstruction, which is based on the idea that in epistemology of experiments, the inductive-like generative justification of knowledge is central. A generative view makes it possible to retain those aspects of experiments which make them purposeful for learning and can give a starting point for students' own construction of knowledge, that is, the generative view makes it possible to retain those aspects of experiments, which make them purposeful for learning by giving a starting point for students' own construction of knowledge during the learning process. The reconstruction also helps to conceive the experiments with their correct historical role and helps to bring back the generative use of experiments in teaching, which after all, has never vanished from the practice of Physics.

2.3 The Attitudes of Student and Teachers towards Physics Practicals

Attitudes are related to coping with and management of the emotions occurring during learning process, and they play an important role in directing human behavior. Whether attitudes occurring as part of a system of values and beliefs are positive or negative affects learning process in a direct manner and influences future lives of individuals (Seferoglu, 2004; Sunbul et al., 2004).

According to Hendrickson, attitudes are the best predictor for estimation of students' success (Hendrickson, 1997). Activities must be planned, organized and implemented so that students may develop more positive attitudes (Pintrich, 1996). Many attitude scales have been developed for the determination of students' attitudes towards Natural Sciences. Regarding these scales, Hewitt (1990), Oliver and Simpson (1988), House and Prison (1998), Geban et all. (1994), Kind et al. (2007) Pell and Jarvis (2001), Reid and Skrybina (2002), Selvi (1996), Bilgin et al. (2006), Nuhoglu (2004,2008), Bozdogan and Yalcin (2005) have developed attitude scales toward physics lessons, physics laboratories, and science lessons Budak (2001) has developed an attitude scale toward chemistry laboratory; Ekici (2002) has developed an attitude scale toward biology laboratory; and Simsek (2002), Kan and Akbas (2005) have developed an attitude scale toward chemistry lessons. Researchers mostly examined attitudes of primary and high school students or candidate teachers, or investigated to the relationship between students' attitude and their success.

Many attitudes scales have been developed for determination of students' attitudes towards Natural Sciences. Some of these have been developed by El-Gendy, (1984), Misiti et al. (1991), Geban et al. (1994), Selvi (1996), Boone (1997), Morrell and Lederman (1998), Francis ve Greer (1999), Pell and Jarvis (2001), Kan (2005)Bilgin et al. (2006), Budak (2001), Reid and Skryabina (2002), Yesilyurt (2004), Nuhoglu and Yalcin (2004), Sengoren et al. (2006), Unal and Ergin (2006), Kind, et al. (2007), Nuhoglu (2008), Azizoglu and Cetin (2009) and Kurnaz and Yigit (2010) for attitudes towards science lessons and science laboratories.

According to Mbajiorgu and Reid (2006), attitudes have four issues that are important in physics. These are attitudes towards physics, attitudes towards physics subjects, attitude toward learning physics, and scientific (the methods) attitude. Physics lessons being held in the classroom on the sole theoretical basis is one of the factors that influence attitude of the students toward these lessons in a negative manner. Thus, physical topics consist abstract concepts should be lectured in the students' daily life, together with simulations, animations and other videos to keep the attention of the students alive. Learning by discovery is better than passive listening, so it should be shown how to associate physical concepts with their daily life of the students. *Hasan Kaya el Ugur Boyuk* (2011)

Instead of increasing physics laboratory lessons' hours, hands-on-science experiments which may be executed with effective, attract attention with simple materials should be developed. Studio physics which is a method of teaching that provides an integrated learning environment with hands-on lab measurements coupled with active student problem-solving should be apply in the physics lessons. In order to make physics lessons more interesting, physics instructors should convince students that physics serves them. Physics instructors should spend more efforts to associate physics–technology–daily life. Physics instructors should like their profession and reflect this to others. Such manners of instructors will improve the attitude of students towards physics lessons and physical experiments. *Hasan Kaya el Ugur Boyuk* (2011)

Poor academic performance in Physics has been a concern in many high learning institutions in the last years around the world. Different authors attribute this poor performance to different causes, namely poor learning environment, poor teaching, inexperienced teachers, learning approaches, cognitive style of students, career interest, influence of parents and friends, low ability of the student, socio economic level and so on (Erdemir, 2009; e.g. Ibeh et al., 2013; Olusola & Rotimini, 2012). But most of them agree on that the attitude of students toward Physics plays a big role in this poor performance. George (2006) defines the attitude toward science as the positive or negative feelings about science, specifically to science classes.

The attitude of a student toward a learning subject has therefore an object of intensive research in the last years to determine its responsibility in poor performance in science in general and in physics in particular. Once this responsibility is determined, researchers seek to find a way to improve the attitude in order to improve students"" performance. Akinbobola (2009) introduced cooperative learning to boost student's attitude toward Physics. She found that students taught using cooperative strategies show more positive attitude toward Physics compare to those taught with competitive and individualistic strategies. Marusic and Slisko (2012) opted for active learning to increase the students" attitude toward Physics. A positive shift of attitudes was observed in both groups of the experiment.

In physics learning, attitude toward physics falls into four categories, namely feeling fond towards physics, pleasuring in the process of learning physics, understanding of physics compared to other problems, and understanding practice in learning physics . The other research found the attitude toward physics into six categories, namely interest, career, the importance of physics, teachers, difficulties in learning, and equipment used in learning physics. Furthermore, Kamba et al. developed parameters of attitude toward physics into four categories, namely student self-concept, anxiety in learning physics, fear of physics learning, and aspiration.

2.4 Engaging on Practicals

A constructivist-inquiry approach can be used for effective teaching and learning science as a contemporary teaching approach that unfortunately teachers/instructors sometimes may not be able to manage properly to arrive at competent level of students' knowledge and skills (Orlik, 2005). The usage of this approach is based on students' actively participation and emphasizes the cooperative and constructive nature of scientific activity. Therefore, students are expected to engage in explaining concepts with their peers and teacher/instructor (Akkus, Gunel, & Hand, 2007).

Students' learning experiences, their experiences with the teacher, teaching approaches of the teacher, and the subject matter itself play a crucial role in formation of students' conceptions concerning the course. Students' conceptions affect their behavior, influencing what the learner selects from the class environment, how they will react to the teachers, the materials being used and their classmates (Shah, Riffat, & Reid, 2007). Science laboratories that are one of the class environments are broadly considered as a key component of science instruction since most science fields such as physics, chemistry, or biology are founded on activity-based investigations in the world even though observations, inferences, imagination, and creativity are parts of nature of science.

Likewise, students are encouraged to make explicit and sound connections among questions, observations, and evidence (Akkus et al., 2007). This approach requires a high level of interaction among the students, the teacher/instructor, the area of study, and available resources (Aladejana & Aderibigbe, 2007). Traditional laboratory activities are already designed for students who follow instructions in their lab manual. Science teachers and science laboratory manuals in general emphasize procedures (Perkins-Gough, 2007). Teachers/instructors often prepare the questions and the tasks to be followed by students before starting the experiments. In other words, problem/questions and procedure/method are always provided to students. Solution can be either provided to students or constructed by students (Fay & Bretz, 2008). In general, the role of the teacher in the traditional lab classes is to transmit the knowledge to students. Students are also expected to receive or memorize the given information. This kind of classes likens teacher centered instruction even though experiments are involved. Thus traditional teacher-centered instruction can have an absence of student centered learning activities (Akkus et al., 2007).

Student achievement and skills improved when an activity-based interactive engagement curriculum was used to teach science (Aladejana & Aderibigbe, 2007; Turpin & Cage, 2004; Welch & Walberg, 1972; Fraser, 1986; Bredderman, 1983; Wong & Fraser, 1996). Students can recognize, design, and apply fundamental science concepts into practice (Akkus et al., 2007). Since students do have some difficulties in understanding the underlying scientific concepts, this activity-based teaching approach can have the potential to excite and enlighten students about the importance of science in their daily lives. It exposes teachers/instructors to classroom activities that combine excitement, cooperative learning, and participatory activities with real-world relevance" (Conlon, 2004). These approaches will motivate students to pursue careers in science, engineering, and technology if it is started to implement at the early level of schools such as primary and secondary schools.

The principal theoretical framework underlying this study is social constructivism that focuses on the environment in which the knowledge is formed and how this environment may influence the individual (Bodner, Klobuchar, & Geelen et al., 2001). Social constructivism would occur when a group of people collaborate to solve a problem or create and prepare an activity. Each person brings a little bit to the interaction, and together they can build knowledge that leads to a solution which each would have been unable to do alone. In this case teacher assists student performance by guiding the discourse among students to support student learning (Chin, 2007).

Meaningful learning in constructivist approach is a cognitive process that students make sense of the world with regard to the knowledge that they have already constructed (Wilson, 1996; Fosnot, 1996; Steffe & Gale, 1995). Some features of the constructivist classroom settings include carrying out some experiments or activities, engaging in meaningful problem-based work and working collaboratively with each other. In addition, constructivism is used to describe a large number of different theories which fall under the general thought that knowledge is constructed (Philips, 1995). Rather than receiving knowledge as a transmission of knowledge that is already complete and ready to use, students build their knowledge on the foundation of what they have previously learned. Students approach a situation with prior knowledge influencing them (Hoover, 1996). For example, students in a physics class will apply what they already know about how objects react when they are sitting in a car going around a sharp turn (Churukian, 2002). The different theories of constructivism are often delineated by adjectives which describe their primary focus. There are different constructivism thoughts of which one is social constructivism is central for this study.

In Science labs, the teacher should assist students in making sense of scientific ideas and support them in applying the ideas (Chin, 2007) and making connections to real life and other disciplines while teaching science. Whereas in traditional science labs, firstly content knowledge or theoretical information is provided by the teachers then students are asked to conduct experiments based on the lab manual which is a kind of cook book. For activity-based interactive engagement approach, students are asked to do activities and the teacher asks questions for brainstorming to explore students' views and gives importance on their views even though their ideas can be different from the scientific views. During continuing discussions, the teacher always asks conceptual questions to elicit students' ideas and facilitate productive thinking, gives constructive and encouraging feedback to students encourages multiple responses (Chin, 2007). These all help students construct knowledge of science by the constructivism- inquiry approach (Roth, 1996; Van Zee & Minstrell, 1997a).

Learning which involve the students going to the laboratory and getting involved in manipulating and observing things in a systematic way can be called practical works. Wherever this exercise takes place it does not matter because it can be in the field to observe animals and plants or it can be an educational trip (Millar, 2004). The increasing availability of information technologies in schools allow students to learn about contemporary scientific research and engage in inquiry at the frontiers of scientific knowledge. In sum, laboratory investigation holds significant promise for being able to support conceptual and epistemological learning when facilitating conditions are put in place for students (Bell, 2005).

Inquiry-type laboratories have the potential to develop students' abilities and skills Such as posing scientifically oriented questions, forming hypotheses, designing and conducting scientific investigations, formulating and revising scientific explanations, and communicating and defending scientific arguments (Hofstein& Mamlok - Naaman, 2007). The effect of demonstration makes little significant contribution to the general and conceptual understanding of the concepts of Physics in cases when students make hypotheses and discuss them, when they create experiments, verify their hypothesis and make conclusions (Svedružić, 2008).

However, the reality on the ground is that most experiments are sterile which are also accompanied with un-illuminating exercises whose purpose is often lost on the learners. In many countries, practical work is ill conceived, confused and unproductive (Hodson, 1991). Whatever is undertaken in the laboratory in the name of practical is not related to science at all. There is usually limited planning and formulation of hypotheses, mostly done by the teachers. In many cases the experiments are derived from mostly irrelevant cultural settings with the attendant equipment disasters. The students follow a fixed program of experimental manipulations and observations set by the teacher, called the cookbook style.

Meaningful practical work is embedded in a discussion of ideas that makes it necessary to check observations and findings against experience and theory. Teachers hold the key to this interchange of ideas. Drawing meanings out of practical and experimental Work requires guided higher-level abstraction Learners can benefit from an inspirational and knowledgeable teacher.

A laboratory activity is a situation where by students is provided with specimens or work guide, including some laboratory equipment's for studying a particular phenomenon. Maduagbun (1984) outlined a number of reasons which he considers as advantage of Laboratory method in science teaching as:

1. Learning through laboratory method extends and re-enforces theoretical learning through reality.
2. Laboratory method offers students to develop scientific thinking carefully and open mindedly.
3. Since the method implies learning by doing, students become more interested due to their involvement.
4. Students familiarize with how scientific recordings, observations and results, summarizing data and drawing conclusion are made.
5. Laboratory method enables Students to handle apparatuses and other instruments thereby developing manipulative skills.
6. Laboratory methods promote problem solving and self-reliance and pleasure.

Similarly, Abdullahi (1982), describes laboratory method as an activity carried out by an individual or group, for the purpose of making personal observations about processes, products or events. Skills which could be developed in the Laboratory during laboratory activities are: manipulative skills, observational skills, critical thinking skills and generalization skills. He added that these skills may show themselves in the cognitive behavior of Students.

Okoli (2017) said that investigative laboratory approach discourages rote memorization of scientific concepts and principles while encourages knowledge and skills acquisition through hands-on-minds on the scientific activities under the guidance of science teachers.

Laboratory experiment is a method of investigating particular type of research question or solving a particular type of problem. Physics and natural science in general are a reasonable enterprise based on valid experimental evidence, criticism and rational discussions.

Experiment plays many roles in physics. Some of these are:

1. Experiment test theories and provides the basis for scientific knowledge.
2. Experiments provide hints toward the structure or mathematical form of a theory in physics and also provide evidence for the existence of the entities involved in our theories.

Laboratory engagement is the important educational and motivational tool in physics education. Physics teachers are often interested in creating school experiments but usually do not think about the concrete implementation of the experiment in teaching and learning physics. Laboratory experience in physics Is a method of verifying an already known field or investigating a less known field, solving practical problems, providing theoretical assumptions which can take place either in the Laboratory or outside the Laboratory (Okoli,2007).

Specific objectives of laboratory may be classified as process-Oriented performance skills and product-oriented performance skills. The learner develops process-Oriented performance skills in practical work if he/she is able to:

1. Select appropriate tools, instruments, materials, apparatus and chemicals, and handle them appropriately.

2. Check for the working of apparatus beforehand.
3. Detect and rectify instrumental errors and their limitations.
4. State the principle/formula used in the experiment.
5. Prepare a systematic plan for taking observations.
6. Draw neat and labelled diagram of given apparatus/ray diagram/circuit diagram wherever needed.

The learner on the other hand developed product-oriented performance skills in practical work if he/she is able to:
1. Identify various parts of the apparatus and materials used in the experiment.
2. Set-up the apparatus according to the plan of the experiment.
3. Take observations and record data systematically so as to facilitate graphical and numerical analysis.
4. Present the observations systematically using graphs, calculations etc. and drawn inferences from recorded observations.
5. Analyses and interpret the recorded observations to finalize the results and Accept or reject a hypothesis based on the experimental findings.

2.5 Effectiveness in engaging in physics Practicals

According to Twoli (1986), major factors which attributes to differences in achievements in science between boys and girls in National examinations include unequal distribution of resources among schools of different types and motivational differences brought about by different cultural backgrounds. Thus, provided the similar environments, girls may perform just as well as boys. Tesfaye & Getinet (2012 carried out an experimental study in Nigeria to investigate on the effects of instructional interventions on students learning gains. The study aimed at investigating the effect of question-answer approach on gain in students' understanding of the basic concepts in Mechanics. The result of the research indicated that students exposed to the question–answer approach with group discussion as a teaching intervention performed better than students taught by teacher lecture on Mechanics Baseline Test (MBT). The current study was designed to investigate the effects of practical work in Physics on students' achievements in Physics

Gotta and Duggan(2003), seen practical work as the teaching and learning approach that develops procedural understanding as well as substantive understanding. Practical work allows learning by doing and is an important experience of one's Own productivity and provides opportunities for significant learning about oneself and the world The development or teachers' favorable attitudes towards science have often been listed as one of the important goals of science teaching. Students enjoy laboratory work in some courses and that generally results in positive and improved attitudes towards science and interest in the science. Newman (2009) wrote: "we observed classes which studied physics and found that with few exceptions pupils enjoyed what they are doing in the laboratory even if difficulties arose in the procedures or even if students became aware that they didn't understand what was happening, it didn't seem to matter". On the other hand, Woolnough and Allsop (1985,p.201) noted that, "many science teachers recognized the importance of practical work. They believed that pupils should have first-hand practical experience in laboratories in order to acquire Skills in handling apparatuses, to measure and illustrate concepts and principles.

Teaching methods are standard procedures employed by a teacher during his lesson (E.G.Rhida, 2019). Teaching methods should be modelled in order to enhance active learning of students. When students are allowed to take responsibility of their learning activities by being active learners, their interests grow and they tend to learn more than when been passive learners; whereby they are not involved in the learning process. These types of teaching methods contribute to the effective performance of students.

According to Ajewole (2000), reported that many methods used in schools did not yield the desired positive effect in physics. Consequently, innovative methods are currently being used and recommended for teaching physics.

Apart from laboratory, demonstration and experiments that can be done in the classroom laboratory for teaching physics, there are also other useful methods involving Students and team in meaningful scientific investigation which can be done even outside of the classroom setting or laboratory. These are field trip and project methods.

Moreover, Aina and Jacob (2011) identified some effect of physics practical as follows:
1. Physics practical encourages learners to develop the spirit of discovery, as a way of acquiring knowledge of physics. Most science concepts are learned by students through discovery method. The teacher normally taught them by conventional method (teacher cantered) but practical work will eliminate or minimize this bad way of learning by allowing students to learn physics concept through practical.
2. It familiarizes with the limitation of data analysis and encourages learners to take caution in drawing conclusions from experimental work.
3. It encourages Students to think clearly and independently and use their own ingenuity and initiative in carrying through an investigation to successful conclusion and then preparing a report for their findings.
4. It enhances the understanding of physics theory and phenomenon. When practical is done, it is a way of understanding the theory very well. It is obvious that most equations, laws and principles in physics can only be verified by practical work. Students often use equations without knowing the relationship between variables but when practical is done Students actualized these existing relationships. For example, Ohm's law in electricity; $V=IR$. Students will know the relationship between current (I). Potential difference (V) and resistance (R) when the law is investigated through practical.
5. Practical work helps the retention of knowledge acquired for a very long time than theory. Students do forget easily things they learned by hearing only but when learning is done through hearing, seeing and manipulation of physical materials as done in physical activities, retention of knowledge is almost permanent.

2.6 Some Challenges encountered in teaching and learning of physics practical

The challenges faced by Physics as a subject include teachers' training and conceptualization of the subject, students' understanding of the subject, physical resources such as laboratories, teaching aids and text books. Research findings suggest that traditional lecture instruction is ineffective in dealing with students' misconceptions. Traditional lecture instruction does not consider the view of students. This technique is limited in helping a learner develop skills (Tarekegn, 2009). The practical approach on the other hand engages the student productively and leads to relational understanding. The proposed study contends that if practical work instructional approach is used perhaps improved students' achievements in the subject may occur. In addition, the enrolment is likely to increase. It is on this basis that the proposed study is designed to investigate the effects of Physics practical work on students' achievements in Physics.

According to Chiu (2000), it has been observed that students taking physics at all levels find it difficult to internalize physics concepts which do not agree with what they had already internalized (Refik & Bahattin, 2008). Furthermore to capture and retain interest in the subject is one of the many difficulties faced by the teachers. A number of research conducted have shown that teaching of physics faces the same problems in the whole world. This is credence by Mac Dermott (1998), who showed that students from different cultural background and social classes have different understanding of physics concepts. However many young people have similar understanding of physics concepts.

A study conducted by Juan (2009) on totalizing of didactic teaching-learning process in physics. The study found out that the teaching and learning physics faces some challenges since its teaching has been largely confined in the classroom. He also found out that the teaching appealed more to the cognitive domain and little on the affective-emotional domain. Teaching and learning physics was individualized. Another finding was that learning was not focused on changing the individual to change the environment but learning was focused on making the individual to fit in the environment. Thus, due to the fore going it is important to change the approaches of teaching so as to improve it and be meaningful. Also, it is worth noting that there is a break down between the practicals and theory taught. The practicals are taught as a different entity from the theory and this does not reinforce concept acquisition. Practicals should be integral part of teaching and theory should be derived from the practical (Juan, 2009). This informed the designing of the current study.

Another challenge facing the Physics as a subject is inadequate content knowledge by the teachers of Physics. Fadaei (2012) carried a research to find out the teachers level of knowledge acquisition. It was based on Force and Motion Conceptual Evaluation (FMCE) for teachers understanding of mechanics concepts. It was administered to a large group of teachers in teacher training courses. The study found out most of the Physics teachers did not completely understand kinematics and dynamics concepts. In addition, Assessments using the FMCE indicate that teacher understanding of dynamics concepts will be improved when some learning strategies are planned.

Therefore, 1) Self-evaluating for teachers to know their abilities and motivating them to be more active in teaching. 2) Recognizing the necessity and planning for teacher training projects have to be emphasized. María et al., (2012) proposed a new approach to teaching Physics having considered a problem within the teaching of Physics, in two aspects: The first, the didactic part, which concerns the professor, since Physics courses, generally, are imparted without giving the student an active role and with knowledge and concepts unlinked of his/her environment, making the teaching and learning of this subject lose its essence and significance. The second, the discipline part, has to do with the student; since it is observed recurrently that even with the education, the student does not use precisely the concepts of a studied theme when explaining or arguing a Physic problem or situation. Particularly within the Heat topic, although there is a daily generalized interaction of people with thermal phenomena.

Evaluation is a key stage in all teaching-learning processes, but it usually demands significant efforts of preparation from students and teachers, not to mention that it is very time-consuming. The traditional model of evaluation prescribes that students must sit periodically to demonstrate that they can recite blocks of knowledge, and solve exercises and problems which usually resemble or refers to the same set of study cases presented in lectures, in the laboratory, or the textbooks. Thus conceived, evaluation is indeed lacking, particularly in Physics teaching. Therefore, there is a need to develop effective physic teaching evaluation methods which puts into consideration the following factors. This includes exploiting the examinations as opportunities for further learning and as a way of acquiring new knowledge, or learning new analytical techniques. It also means seeing examinations as an opportunity for the application of standard powerful tools which students learned in their previous mathematics and Physics courses (Celso, 2009).

Klainin, (2009) identified some problems of practical work schools as experienced by teachers and students in both developed and developing countries. These problems are associated with curriculum implementation, change of emphasis in school curriculum, problems of incentives and problems associated with goals that could be attained by practical work. Problems associated with curriculum implementation include the lack of equipment, enough time for practical work. Safety precautions in the laboratory and student's participation. Those associated with incentives include the value of practical work held by students, teachers and Curriculum developers, and the lack of reward for students.Practical work for school science classes might be very expensive in money, time and human resources. Third world countries have not been reluctant in designing their science curricula to accept the challenge of using practical-based approaches to school learning. As a result, many problems then arise. How can equipment's be obtained? How can it be stored? How can large classes experience activities when only one set of equipment is available?

Given the importance of practical work in enhancing understanding, ample time and resources should be made available to schools. This will enable science teachers to ensure attainment of science content and processes. There was a significant difference between teachers who have science laboratories and those who have not. The teachers who found their laboratories well-equipped wanted to do more practical are compare to those whose laboratories were inadequate. Having no science laboratory or inadequate equipment's in science laboratories in schools affect teachers' attitudes towards the arms of science experiments. The teachers' opinions related to the non-existence of laboratories and inadequate equipment in laboratories may prevent them from the idea of doing simple experiments under the current skimpy circumstances. Thus, an idea that only when there is well-equipped laboratory, they can perform science experiments and reach their goals (Gary Ford,2008).

Halai (2008) states that there is a significant shortage of science teachers in schools and that the situation is much more in rural areas. She also mentions that there are some teachers who never studied science in school yet teach science subjects because of the shortage of Science teachers. Kasanda (2008) notes that there is a lack of science teachers, Such teachers, even in countries, as Canada, USA, UK and Sweden. Halai (2008) states that the shortage of science teacher creates extra workload for the teachers which compels them to teach which compels them to teach a large number or classes with a large number of students, and that is why they ton Students, and that is why they tend to focus on covering the syllabi for the examinations. Ranade (2008) mentions that large class size is a hindrance for the teachers trying to use activity methods and it leads them to the teaching of science through the over use of lecture met.

According to Ng'ethe (2012) Students exposed to practical work in Physics performed better than those taught through conventional method. The value of practical work has long been recognized at the secondary school level. Many teachers acknowledge the value of learning by doing rather than theory only. (Driver and Braund, 2002). According to Hodson (1990) it is advisable that students should be prepared with mastery of the skills required for practical work so that they will be ready for assessment. Hodson (1996) further added that in practical work the candidate performs certain activities in order to discover something as yet unknown, to test a hypothesis or to check an already known fact. In order to perform these activities, the candidate has to learn the skills required for practical work, which includes preparing and performing experiments and processing the results obtained. Woolnough and Allsop (2001) noted that many science teachers recognized the importance of practical work. They believed that students should have first-hand practical experience in laboratories in order to acquire skills in handling apparatus, to measure and to illustrate concepts and principles. Having firsthand information will allow students to apply the skills acquired during practical work when they become scientists in future. Physics, like religion is a search for truth. Hence to a student physics should be as sacred and as pious as the place of worship to a devotee. In fact physics study enables young minds to equip themselves for something higher and noble as search for truth and unrevealing the mysteries of nature. Demonstration of experiment is important for understanding the principles of physics. However, performing experiments by one's own hand is far more important because it involves learning by doing. It is necessary to emphasize that for a systematic and scientific training of young minds, a genuine laboratory practice is a must. According to educational psychologists the attitude of the student plays an important role in his systematic and scientific training. Science is a great human expertise. Open mindedness, curiosity, collection of data, demand for verification and proofs statistical reasoning, suspended judgments, acceptance of warranted conclusion and willingness to change over opinion in the light of new evidence are the ferments which characterize the scientific enterprise.

Appropriate practical work can be effective in helping teachers construct their knowledge, develop logical and inquiry-skills, problem-solving abilities, and can also assist in the development of manipulative and observational skills. Physics practical has a great potential in promoting positive attitudes and in providing students with opportunities to develop skills. In this respect the science laboratory is a unique learning environment as it would provide science teachers with opportunities to vary their instructional techniques. Ahiakwo (2002) suggested that practical works as a unique social setting has great potential in enhancing social interactions that can contribute positively to developing attitudes cognition in students. Nzewi (2008) asserted that practical activities can be regarded as a strategy that could be adopted to make the task of a teacher more real to the student as oppressed to abstract on theoretical presentation of facts, principle and concept of subject matters. It is of important that the use of practical approach to the teaching of physics should be implemented in schools if we hope to produce students that will be able to acquire the necessary knowledge, skills and competence needed to meet the scientific and technological demands of the nation.

A study by Owolabi (2004) revealed that the performance of Nigeria students in ordinary level physics was generally poor. Jegede, Okota & Eniayeju (1992) reported factors responsible for poor implementation of practical work in physics as; poor laboratory facilities, inadequate number of learning facilities among others. Physics as a science subject requires trained technicians and laboratory attendant (instructors). In many school due to lack of these technicians and attendants, the teaching of physics have been based largely on the expository strategy of teaching which encourage rote (memorization) of factual details with minimum emphasis on practical.

Today the students perform experiments for the sake of marks and teachers have failed to realize that ''practical work'' can aid them to effectively carry out their lessons. As a result of this, students at the senior secondary are not able to observe and draw inferences from their observation, tackle problems scientifically and even handle simple apparatus to verify principle so as to aid comprehension. This has led to student poor performance in physics practical leading to their failure in physics examinations.

3. Research Methodology

3.1 Introduction

This chapter is going to discuss the methodology applied in this research on the Impact of Physics Practical on the Teaching and Learning of Senior Secondary School Physics in selected schools in Bo City

3.2 Study Area

Bo city started as a one-hut settlement, long before the colonial era in the country? It was started by two great friends and hunters, Pa Kobongor and Pa Saffa. According to tradition, Pa Kobongor came from Fembeya in the present Kono District and came to Banda in the present Bo District. Banda is now called Kendeiyela along the Bo/Koribondo highway. At Banda, Pa Kobongor, a great hunter, met Pa Saffa, another great hunter and the two became inseparable friends. From Banda, the two used to go on hunting expeditions around and beyond. They were indeed very successful. During one of their trips, they came to a spot by a swamp river which highly fascinated them for its natural beauty:- its good drinking water, vast swamp and a flat land. Due to these facilities they used to pay intermittent visits there. Later they decided to go and stay there permanently. As a result a portion was brushed and a dwelling hut was put up. As this happened, they transferred there, but were soon followed by people from Banda and other villages. Thus by this gradual influx of the people, the one hut settlement enlarged in size and in population. As the people settled they decided to name their settlement; and it was named as “Bowel” due to its clayish nature, which means clayish land in the Mende language. But the name was later changed to ‘80’ by the colonial master, who found it very difficult to pronounce the local Mende name. Though the settlement appeared to be good, yet there were few eventualities which created great fear in the minds of the settlers. Two main things were responsible for that; the first was that the river around the area had a Bondo Devil. The head of this devil used to appear on the river, whenever it appeared it danced vigorously leaving the water very muddy and clayish in colour. Thus the frequent clayish nature of the water made Pa Saffa to name it as Kobongor after his friend, Pa Kobongor. The reason for such a name was not given, but it could not be unconnected with the grey hair and bear of Pa Kobongor. This name is now given to all the swamp waters in the City of Bo. Bo City is in the Kakua Chiefdom in the Southern Province of the Republic of Sierra Leone

Bo, commonly referred to as Bo Town, is the second largest city in Sierra Leone by geographic location after Freetown and the largest city in the southern province. Bo is the capital and administrative centre of Bo District. The city of Bo had a population of 149,957 and 174,354 in 2004 and 2015 censuses respectively (SSL, 2004 & 2015) and had a population of about 233,684 based on 2017 estimate. Bo is an urban centre, and lies approximately 160 miles (250 km) south-east of Freetown and about 40 miles (71 km) to Kenema. Bo is the leading financial, educational and economic centre of the southern Sierra Leone.

Bo city is about six miles in diameter and made up of lot of sections. Some of these sections are:- Samamie, Durba Ground, New York, New London, Kandeh Town, Njagboima, Moriba Town, New Site, Shellmingo, Kissy Town, Kulanda Town and many more. Each of these sections is large, highly populated and with lots of modern facilities.

In terms of schools, there are total of 319 schools of which twenty two (22) senior secondary schools, sixty one junior secondary schools, two hundred and nineteen (209) primary school and ninety nine (99) pre-primary school. These 319 schools in Bo city, thirty four are owned by the community, 51 are owned by governments, 219 are owned by mission and 87 by private individuals The average class size in B o city in the senior secondary schools, junior secondary schools, primary school and Pri-School are 71, 63, 49 and 31 respectively. The overall teaching profession in Bo city is dominated by men. There is a large difference between male and females teachers at every city and school level with far more male teachers than female teachers except at the pre-primary level. (2019 Annual School census by MBSSE).

3.3 Research Design

This research requires the satisfaction of all three common research purposes; exploration, description and explanation (Babbie, 1992). Surveys, interviews, observations, document and analysis are the major techniques used in this study. The study uses mixed methods, that is, both quantitative and qualitative approaches.

Surveys are useful and efficient for collecting data from a large population, and also an excellent means for measuring attitudes and orientation. As Krathwohl (1993) stated “surveys are halfway house on the qualitative-quantitative continuum” (p. 360), if surveys are made by interview or open-ended questionnaires they will be qualitative or made by closed or multiple choice questions they will be quantitative. Survey research collects data from a sample, records and analyses the responses, and generalised to its population (Krathwohl, 1993).

Questionnaires are commonly used to collect data in survey research (Babbie,1992). Each item must be relevant to the aims and objectives of the research, written in a simple and clear sentence, not more than one question in an item, and must not have any bias.

An interview is an alternative method of collecting survey data. Interviewing is typically conducted in a face-to-face encounter between interviewer and interviewee, but a telephone interview could be done as well (Babbie, 1992). Generally, there are two types of interview, structured and unstructured interviews. A structured interview consists of a set of questions to be asked in an orderly sequence. When the researcher has developed a clear idea of the area of interest, a structured interview is a very useful method. If the area of research is only generally specified, the unstructured interview could be more useful to adopt (Reaves, 1992).

Observation is a method of collecting data by a person – an observer, or by the other means of making an audio or video recording of the phenomenon of interest. The advantage of observation is that it records actual behaviour of the people in the situation, which may differ from their answers to questionnaires or interviews. Observation therefore can be used to check the validity of subjects’ responses.

However, the people who are aware that they are being observed tend to behave differently from how they do in an ordinary situation (Krathwohl, 1993). In particular, classroom observation is a collaborative process of both the observer and the people being observed. Collaboration between the researcher, and the teacher and students in the class before, during and after observation can help all participants be at ease and gain the most benefit from the experience. The analysis of important documents such as syllabus statements, teaching programs, students’ notebooks and examination papers can provide invaluable information about current policies, intended and implemented curricula.

The research methods have been used to provide complementary information from different sources so that triangulation of data will provide greater confidence in the research findings.

3.4 Population of the study

The population of the study includes all the science students in SSS II and SSS III and Physic Teachers in the selected Senior Secondary Schools in Bo City. Six Senior Secondary School was selected. Below is a table showing the Six Senior Secondary School and teacher population.

Table 1: Population of the study

S/N	Name of School	Number of Physics Teachers	Total Number of students
1	Bo Government Secondary School	2	83
2	Queen of the Rosary Secondary School	2	81
3	Christ The King College	3	185
4	Ahmadiyya Senior Secondary School Bo	3	254

5	SOS Hermann Gmeiner International School Bo	1	23
6	Allawalie International Academy	1	50
Total		**12**	**676**

Source: Field Survey 2021

3.5 Sample and sampling technique

Table 2: Students and Teachers selected per each school

S/N	Name of School	Number of Teachers Selected Per School	Total Number of Pupils Selected Per School
1	Bo Government Secondary School	2	21
2	Queen of the Rosary Secondary School	2	20
3	Christ The King College	3	45
4	Ahmadiyya Senior Secondary School Bo	3	64
5	SOS Hermann Gmeiner International School Bo	1	06
6	Allawalie International Academy	1	13
Total		**12**	**169**

Source: Field Survey 2021

The sampling procedure that was used for the students is propulsive and for the teachers is stratified
This implies that total of (169) students and ten (12) teachers were selected to represent the entire physics students in the six schools to be selected. The schools and the number of students and teachers that were selected per each school are shown in the table above. This represents 25% of the entire population of the students in the school to be selected and 100% of the teachers to be selected.

3.6 Data collection instrument

The main instrument used for the data collection in this research was two sets of structured Closed-ended questionnaire for senior secondary school teachers and students.
The questionnaire for the teachers consist of section A on the Demographic Characteristic of the Teachers, Section B on the Knowledge of Teachers in Physics Practicals, Section C on the Attitudes of Teachers Towards Physics Practicals, Section D on the Engagement of Teachers in Physics Practical, Section E on the Effectiveness of teaching physics practical's and Section F on the factors affecting the teaching and learning of physics practical's
The questionnaire for the students also consist of section A Demographic Characteristic, Section B on the Knowledge of Students in Physics Practicals, Section C on the Attitudes of Students Towards Physics Practicals, Section D on the engagement of Students in physics practical, Section E on the effectiveness of Learning physics practical's and Section F on the factors affecting the learning of physics practical's

3.7 Validity and Reliability of the instrument

The validity of the instrument is defined as the degree to which a measuring tool claims what its measures while the Reliability is defined as the consistency of the measurement of a research instrument. In order to ensure the validity of the instrument, the questionnaire was given to my supervisor, colleagues students and subject expect for moderation. They Items required were used and those that are not required were deleted. A split- half reliability test was used to ascertain if the instrument will be reliable. A correlation co – efficient was determine using Spearman correlation coefficient.

3.8 Source of Data

Data for this study was collected from primary and secondary sources. The primary sources of data was collected through personal observations, information conversations, face – to – face, personal interviews with respondents using a semi structured questionnaire. The secondary sources of data was derived from the Assessment of Physics Practical's related literatures, in textbooks, journals and internet Written sources. Chapter two of this research work make used of the secondary data

3.9 Data Collection Procedures

The method that was employed in caring out this research was divided in to three phases.
Phase I: This was the period used to legitimize the research. As tradition demands, I visited the study area within the delimited schools and inform the school authorities about my research in their area. I also used the visit to familiarize myself with the schools in order to ease the data collection process
Phase II: This was the period during which the data for the research was collected
Phase III: This period was used to analysis and present the data that was collected for the field

3.10 Methods of Data Analysis

Acquired data were analyzed by using Statistical Package for Social Sciences 26.0 (SPSS 26.0) and excel programs. In this analysis, primarily descriptive statistics (frequency, percentage, mean, standard deviation) was calculated and the distribution characteristics have been revealed. For each question in the survey, students 'and Teachers level of participations as [(1) strongly disagree, (2) Slight disagree. (3) disagree, (4) Agree, (5) slightly Agree, (6) strongly agree] for the negative comments, and as [(1) strongly disagree, (2) disagree, (3) agree, (4), strongly agree] for the negative comments. Therefore, maximum students' attitude scores are 52 points, minimum is 4 points. The tools that was used in the analysis was frequency distribution table, graphs and charts

3.11 Ethical Consideration

Prior to the distribution of questionnaires, I visited the schools and notified the schools heads about the research and ask for their permission. Upon their permission utmost commitment by heads to choosing a convenient time to come in order to have access to the teachers and students to administer the questionnaires. Secrecies of the respondents were guarantee and it was being made clear that the research is for academic purpose.

4. Analysis of Results

4.1 Introduction

This chapter presents, interprets and discusses the findings generated from this study and reported using mainly tabular mode and graphs. The chapter specifically considers and explains the Demographic Characteristic of the teachers and student, the Knowledge of teachers and students on physics Practicals, the attitudes of teachers and students towards physics Practicals, the engagement of teachers and students on physics Practicals, the effectiveness in the teaching and learning of physics Practicals and the factors affecting the effective teaching and learning of physics Practicals of Senior Secondary Schools Physics in Selected School in Bo City. They are presented and discussed under sub – heading that are reflections of the objectives of the study. There were one hundred and eighty one questionnaires administed and one hundred and sixty six were responded to. This one hundred and sixty six that were responded to comprises of twelve teachers and one hundred and fifty four students in all the schools selected.

4.1.1. Demographic Characteristics of Respondents

4.1.2 Demographic Characteristics of respondents of Teachers

In this section, results on the Demographic Characteristics of respondents of Teachers are discussed. Twelve (12) respondent were asked question about the type of school they teach, their gender, age limit, teaching experience, highest academic qualification and Employment status

Table 1: Demographic Characteristics of respondents

	Category	**Frequency**	**Percent**
Type of School	Boys school	6	50.0
	Girls school	1	8.3
	Mixed school	5	41.7
Gender	Male	12	100.0
	Female	0	0.0
Age (Years)	Under 17	0	0.0
	17 – 27	0	0.0
	28 - 38	3	25.0
	39- 49	3	25.0
	50- 60	6	50.0
	61 and above	0	0.0
	Category	Frequency	Percent
Teaching Experience (Years)	0-5	1	8.3
	6-10	2	16.7
	over 10	9	75.0
Highest academic qualification	WASSCE	1	8.3
	Higher Diploma/HTC	1	8.3
	Bachelor Degree	8	66.7
	Master's Degree	2	16.7
Employment status	Part time	5	41.7
	Full time	4	33.3
	Volunteer	3	25.0

Among the twelve (12) respondents 50% of the respondents are teachers teaching in boy's school and 8.3% are teaching in Girls school. 100% of the respondents are male. This simply means there is no female teacher of physics in the school selected.

The age range 50 – 60 years has high frequency with 50% indicating that they formed the Major respondents from the random sampling. Next are the age's range 28 – 38 and 39 – 49 have the same frequency of 25% each. It's simply mean that the respondents are highly experienced. 66.7% of the respondent has Bachelor Degree. Even thou 66.7% have Bachelor Degree only12.5% did Bachelor of Science Education in Physics.

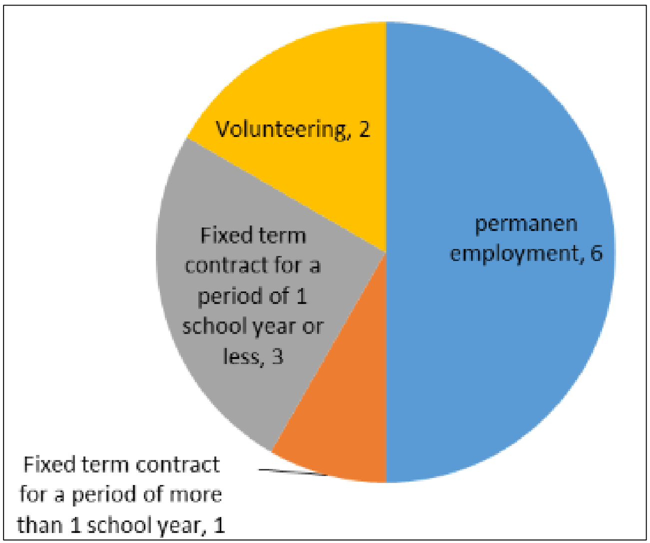

Fig 1: Employment status of Respondents

From figure 1, 41.7% of the respondents are part time teachers and 33.3% are full time teachers teaching in school while 25% are volunteer teachers teaching in the schools. The predominance of the non-full time teachers is as a result of teachers not recruited on time and the insufficient of physics teachers.

4.1.3. Demographic Characteristics of respondents of students

Table 2: Type of School of Respondents

Type of school	Frequency	Percent	Cumulative Percent
Boys school	41	26.6	26.6
Girls school	35	22.8	49.4
Mixed school	78	50.6	100.0
Total	154	100.0	

Among the one hundred and fifty four (154) respondents 50.6% of the respondents attend mixed school and these schools include Ahmadiyya Senior Secondary School Bo, SOS Hermann Gmeiner International School Bo and Allawalie International Academy. 49.4% of the responded attend co-educational Schools which include Bo Government Secondary School, Queen of the Rosary Secondary school and Christ the King College.

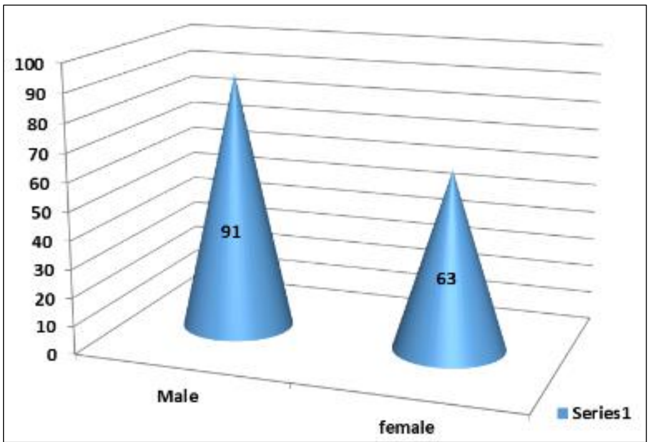

Fig 2: Gender of Respondents

From the above figure 59.1% of the respondents interviewed were males and 40.9% were females. This shows that more male student where interviewed than female students.

Table 3: Age ranges and classes of Respondents

Age Ranges	class		Total
	SSS2	SSS3	
12-15years	8	3	11
16-18years	40	82	122
19-and above	7	14	21
Total	55	99	154

Among the one hundred and fifty four (154) respondents 79.2% of the respondents are in the ranges of 16 – 18 years and 67.2% are in SSS 3. 7.1% of the respondents are within the age bracket of 12 – 15 years. Among these respondents in the age bracket of 12 – 15 years 72.7% are in SSS2. These indicate that most of the respondents are teenagers.

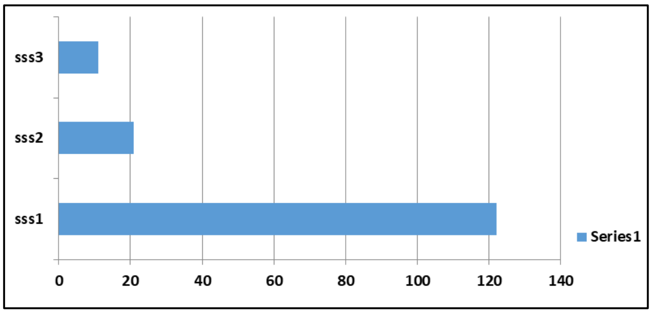

Fig 4: Level of Admission of Respondents in the SSS Classes

Among the one hundred and fifty four (154) respondents 79.2 % of the respondents were admitted in SSS 1, 13.6 were admitted in the SSS 2 while 7.1% were admitted in SSS 3. This result clearly shows that 92.8 % of the respondent has been assessed by the school internal examinations.

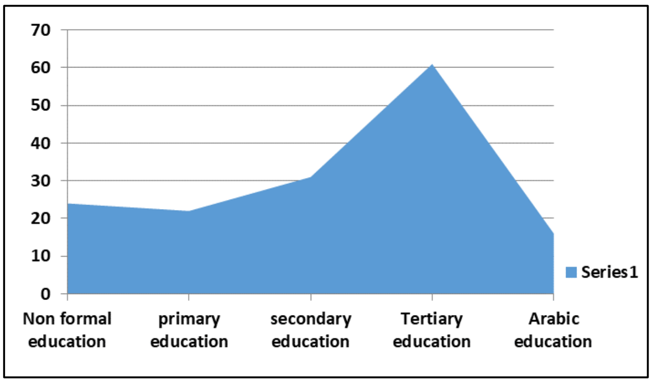

Fig 4: Educational level of Guardian of Respondents

Among the one hundred and fifty four (154) respondents 84.4 % of the respondents of guardian have formal Education while15.6% of the respondents of guardian did not have formal Education. In the 84.4 % of the respondents of guardian having formal Education, 39.6% attained Tertiary education in English Education.

4.2. Knowledge of Respondents on Physics Practicals

4.2.1 Knowledge of Teachers on Physics Practicals

In this section, results on the Knowledge of Teachers on Physics Practicals are discussed. Twelve (12) respondent were asked question on whether the have knowledge on the statements on the tab le 4 consider to be Physics Practicals knowledge

Table 4: Knowledge of Teachers Respondents on Physics Practicals

No	Statement of Respondents	Yes		No	
		N	%	N	%
1	I have heard of the term physics Practicals	12	100	0	0.0
2	I have knowledge in observing safety rules in the laboratory	08	66.7	04	33.3
3	I have knowledge in setting up an experiment	03	25.0	09	75.0
4	I have knowledge in performing experiments	10	83.3	02	16.7
5	I have knowledge in interpreting diagrams	03	25.0	09	75.0
6	I have knowledge in identification of apparatus	12	100	00	0.0
7	I have knowledge in collecting data from an experiments	10	83.3	02	16.7
8	I have knowledge in planning for an experiments	03	25.0	09	75.0
9	I have knowledge in plotting graph and determine of slope and intercept	07	58.3	05	41.7
10	I have knowledge in following experimental procedure	06	50.0	06	50.0
11	I have knowledge in measuring correctly with correct precision	03	25.0	09	75.0
12	I have knowledge in record readings obtained from an experiment	03	25.0	09	75.0
13	I have knowledge in the construction of composite table	03	25.0	03	75.0
14	I have knowledge in reading the question paper or manual and interpreting it	03	25.0	09	75.0
15	I have knowledge in presenting data from experiments, investigations, or simulations	03	25.0	09	75.0
16	I have knowledge in following instructions and demonstrate the activities of the instruction	04	33.3	06	66.7
17	I have knowledge in interpreting physics practical result correctly	03	25.0	09	75.0
18	I have knowledge in the types of Physics Practicals	12	100	00	0.0
19	I have knowledge in the types of Physics Practicals for WASSCE purpose	12	100	00	0.0
20	I have knowledge in the different parts of a graph to be plotted	09	75.0	03	25.0
21	I have knowledge in stating precautions	08	66.7	04	33.3
22	I have knowledge in the rules and regulations on physics Practicals	02	16.6	10	83.4
23	I have knowledge in choosing correct scale	3	25.0	09	75.0
24	I have knowledge in using correct units	12	100	00	0.0
25	I have knowledge in reading of instruments	09	75.0	03	25.0
26	I have knowledge in labelling of diagrams	09	75.0	03	25.0
27	I have knowledge in applying right materials /equipment	01	8.3	11	91.7
28	I have knowledge in analyzing data correctly	07	16.7	05	83.3
29	I have knowledge in the right mathematical foundation	07	58.3	04	41.7
30	I have knowledge in organizing students for practical's	03	25.0	09	75.0
31	I have knowledge in the Penalties on wrong plotting of graph	01	8.30	11	91.7
32	I have knowledge in interpreting of laboratory manual or question paper	02	16.6	10	83.4

N = frequency of selected option and % = Percentage of frequency

Among the twelve (12) respondents of teachers, 100% of them said they have had of the term physics Practicals, they are knowledgeable in:- identifying Physics apparatus, general types of Physics Practicals, types of Physics Practicals for WASSCE purpose and using correct units. 83.3% of the respondent said they are knowledgeable in collecting data from an experiment while 75% of the respondent said they are knowledgeable in: - different parts of a graph to be plotted, reading of instruments and labelling of diagrams.

Similarly Among the twelve (12) respondents of teachers, 91.7% of them responded by saying that they are not knowledgeable in:- applying the right materials /equipment and Penalties on wrong plotting of graphs. 75% of the respondent said they are not knowledgeable in:- setting up an experiment, interpreting diagrams, planning for an experiments, measuring correctly with correct precision, recording readings obtained from an experiment, construction of composite table, reading the question paper or manual and interpreting it, choosing correct scale of a graph and organizing students for practical's. While 66.7% of the respondent said they are not knowledgeable in presenting data from experiments, investigations, or simulations. This result shows that the teachers are not knowledgeable enough to teach physics Practicals.

4.2.2 Knowledge of students on Physics Practicals

Table 5: Knowledge of students Respondents on Physics practical

No	Statement of Respondents	Yes		No	
		N	%	N	%
1	I have heard of the term physics Practicals	128	83.3	26	16.7
2	I have knowledge in observing safety rules in the laboratory	130	84.5	24	15.5
3	I have knowledge in setting up an experiment	53	34.5	101	65.6
4	I have knowledge in performing experiments	72	46.8	82	53.2
5	I have knowledge in interpreting diagrams	51	33.2	103	66.8
6	I have knowledge in identification of some of the apparatus	97	63.1	57	36.5
7	I have knowledge in collecting data from an experiments	68	44.2	86	55.8

8	I have knowledge in planning for an experiments	56	36.4	98	63.6
9	I have knowledge in plotting graph and determine of slope and intercept	27	17.6	127	82.4
10	I have knowledge in following experimental procedure	72	46.8	82	53.2
11	I have knowledge in measuring correctly with correct precision	29	18.9	81.1	75.0
12	I have knowledge in record readings obtained from an experiment	30	19.5	124	80.5
13	I have knowledge in the construction of composite table	12	7.8	142	92.2
14	I have knowledge in reading the question paper or manual and interpreting it	61	39.7	93	60.3
15	I have knowledge in presenting data from experiments, investigations, or simulations	13	8.5	141	91.5
16	I have knowledge in following instructions and demonstrate the activities of the instruction	27	17.6	127	82.4
17	I have knowledge in interpreting physics practical result correctly	28	18.2	126	81.8
18	I have knowledge in the types of Physics Practicals	148	96.2	06	3.8
19	I have knowledge in the types of Physics Practicals for WASSCE purpose	134	87.1	06	12.9
20	I have knowledge in the different parts of a graph to be plotted	149	96.9	05	3.1
21	I have knowledge in stating precautions	26	16.9	128	83.1
22	I have knowledge in the rules and regulations on physics Practicals	02	1.3	152	98.7
23	I have knowledge in choosing correct scale	28	18.2	126	81.8
24	I have knowledge in using correct units	149	96.9	05	3.1
25	I have knowledge in reading of instruments	18	11.7	136	88.3
26	I have knowledge in labelling of diagrams	42	27.3	112	72.7
27	I have knowledge in applying right materials /equipment	26	16.9	128	83.1
28	I have knowledge in analyzing data correctly	39	25.4	115	74.6
29	I have knowledge in the right mathematical foundation	30	19.5	124	80.5
30	I have knowledge in organizing my colleague students for practical’s	06	3.9	148	96.1
31	I have knowledge in the Penalties on wrong plotting of graph	25	16.3	129	83.7
32	I have knowledge in interpreting of laboratory manual or question paper	18	11.7	136	88.3

N = frequency of selected option and % = Percentage of frequency

Among the one hundred and fifty four (154) respondents of students, 96.9% are knowledgeable in using correct units and different parts of a graph, 96.2% are knowledgeable in the types of Physics Practicals,87.1% are knowledgeable in the types of Physics Practicals for WASSCE purpose,84.5% are knowledgeable in observing safety rules in the laboratory,83.3% are knowledgeable on the term physics Practicals and 63.1% are knowledgeable in the identification of some of the physics practical apparatus

Similarly among the one hundred and fifty four (154) respondents of students, 98.7% are not knowledgeable in the rules and regulations on physics Practicals, 96.1% are not knowledgeable in organizing there colleague students for practical’s,92.2% are not knowledgeable in the construction of a composite table, 91.5% are not knowledgeable in presenting data from experiments, investigations, or simulations,88.3% are not knowledgeable in interpreting of laboratory manual or question paper and in reading of instruments, 83.7% are not knowledgeable in the Penalties on wrongly plotting of graph, 83.1% are not knowledgeable in applying right materials /equipment and in stating precautions 82.4% are not knowledgeable in following instructions and demonstrating the activities of the instruction and in plotting graph and determination of slope and intercept, 81.8% are not knowledgeable in choosing correct scale and in interpreting physics practical result correctly 80.5% are not knowledgeable in the right mathematical foundation and in recording readings obtained from an experiment. 74.6% of the respondents are not knowledgeable in analyzing data correctly, 66.8% are not knowledgeable in interpreting diagrams, 65.6% are not knowledgeable in setting up an experiment, 63.6% are not knowledgeable in planning for an experiment and 60.3% are not knowledgeable in reading the question paper or manual and interpreting it. This result shows that majority of the students targeted are not knowledgeable enough in physics practical’s since the statements on table 5 help to evaluate the knowledge of students in physics practical. A student who cannot follow instruction would not be able to interpret laboratory manual or question paper. A student who cannot interpret laboratory manual or question paper would not be able to set up experiments since the apparatus comprises of symbol which are in a diagram form on the manual or question paper. A student who cannot read or interprets the apparatus would not be able to get result. If there are no result then data cannot be recorded and analysis. To record data it must be organized hence a composite table is required. If a student does not know how to construct a composite table then data obtained from the experiment would not be organizes. When data are not organized it is very difficult for it to be analysis. A student who cannot plot graph would not be able to determine the slope and intersect(s). Hence in analyzing of results in physics practical, it involves plotting of graph, determination of slope and intercept. In performing experiment, construction of composite table, plotting of graph and determination of slope and intercept there are rules and regulations which are referred to as instruction in physics Practicals. These instructions most be understood. Finally in performing an experiment there are certain things they students most do and not do, these things are referred to as precautions. Even when precautions are known, they have a way of writing them for them to be accepted to be correct. So when students do not have knowledge on these issues it means they don’t have knowledge in Physics. They parameters of following instruction, performing experiments, collecting data, recording data, processing result are connected.

As a result the knowledge of the parameters most be understood in the order of following instruction to performing experiments to collecting data to recording data and to processing data to get result that will lead to a reasonable conclusion experiment which will be considered as Physics Practicals.

4.3. Attitudes of Respondents towards Physics Practicals

4.3.1 Attitudes of Teacher towards Physics Practicals

Table 6: The Attitude of Teachers Respondents on Physics Practicals

Attitude	Frequency	Percent
Positive attitude	03	25.0
Negative attitude	05	41.7
Moderate /Average	04	33.3
Total	12	100.0

Among the twelve (12) respondents of teachers, 41.7% has negative attitude in the teaching of Physics Practicals, 33.3% has Moderate/average attitude in the teaching of Physics Practicals while 25.0% has positive attitude in the teaching of Physics Practicals. Because of the negative and moderate attitude in teaching Practicals that is why most of the respondent doesn't have knowledge in Physics Practicals

4.3.2 Attitudes on several concerns of Teachers

Overall teacher's interaction when teaching in class, Likert-type attitude scale scores were worked out for each of the categories of respondents. The percentages of respondents scoring strongly Disagree, slightly Disagree, Disagreed, Agreed, Slightly Agreed and Strongly Agreed on their attitude were determined. These findings are shown in table 7 below. The teachers Questionnaire was used to investigate the Attitudes of Teacher towards Physics Practicals. The attitudinal concerns that were investigated were:

A: Physics practical lessons are difficult to teach
B: Physics Practical teaching is boring
C: I would not like to have more physics practical lessons at school
D: I don't like Physics practical teaching more than the theory teaching
E: I would not teach more physics Practicals if I had that opportunity
F: I do not want to hear even the name of Physics Practicals
G: I like Physics practical teaching because I decide what to do myself
H: Physics practical teaching is not exciting

Table 7: Teachers attitude towards Physics Practicals

Do you agree with these views?	Attitude Scored (N = 12)					
	Strongly Disagreed (N, %)	Slightly Disagreed (N, %)	Disagreed (N, %)	Agreed (N, %)	Slightly Agreed (N, %)	Strongly Agreed (N, %)
A	2(16.7)	1(8.3)	1(8.3)	2(16.7)	0(0.0)	6(50.0)
B	1 (8.3)	1(8.3)	0(0.0)	1(8.3)	2(16.7)	7(58.3)
C	2 (16.7)	0(0.0)	2(16.7)	2(16.7)	0(0.0)	6(50.0.)
D	3 (25.0)	0(0.0)	0(0.0)	4(33.3)	1(8.3)	4(33.3)
E	3 (25.0)	1(8.3)	1(8.3)	2(16.7)	1(8.3)	4(33.3)
F	2 (16.7)	1(8.3)	0(0.0)	1(8.3)	2(16.7)	6(50.0)
G	1(8.3)	1(8.3)	0(0.0)	1(8.3)	1(8.3)	8(66.7)
H	4(33.3)	0(0.0)	1(8.3)	1(8.3)	1(8.3)	5(41.7)

In order to determine the participating teacher' attitude towards physical experiments, 8 attitude items were asked to the teacher. Frequency and percentage values of the replies given by the teacher for each attitude items are given in Table 7. As shown in Table 7, teachers who participated in the survey replied to attitude items of answered affirmative questions such as *"Physics practical lessons are difficult to teach"* 66.7%, *"Physics Practical teaching is boring"* 83.3%, *"I would not like to have more physics practical lessons at school"* 66.7%, *"I don't like Physics practical teaching more than the theory teaching"* 58.3%, *"I would not teach more physics Practicals if I had that opportunity"* 58.3%, *"I do not want to hear even the name Physics Practicals"* 75.0%, *"I don't like Physics practical teaching because I decide what to do myself"83.3%* and *"Physics practical teaching is not exciting"* 58.3% in high rates reported opinions of "strongly Agree" or slightly "Agree" or "Agree". On the other hand, teacher replied to 8th attitude item reading as *"Physics experiments in the physics lessons are boring"* was replied opinion of "Strongly Agree" or slightly Agree or "Agree*"* in range of 71.2% by the participating teachers. An overall view of the answers of teachers' regarding their attitudes towards physical experiment, as shown in Table 7, most of the teacher thinks that physics experiments are difficult and not easy. Teacher' attitude scores towards physics experiments were calculated in the same way of the attitude scores towards physics lessons. As a result of this questionnaire with 8 attitude items that could be maximum of 48 points, the average attitude scores towards physics experiments of student was calculated as X = 33.7. In addition, the attitude scores towards physics experiments of students in the lowest 8, highest was 42 points. When it is considered that in generally view to entirely indecisive students the average score attitude scores towards physics experiments should be 21, from the statistical results, it can be concluded that teachers have positive interest and attitude towards physics Practicals, is understood to be high rate of interest, expectation and success in physics experiments.

4.3.3 Attitudes of students towards Physics Practicals

Table 8: The Attitude of Students Respondents on Physics Practicals

Attitude	Frequency	Percent
Positive attitude	20	13.0
Negative attitude	80	51.9
Moderate /Average	54	35.1
Total	154	100.0

Among the twelve (154) respondents of students, 13.0% has negative attitude in the learning of Physics Practicals, 51.9% has Moderate/average attitude in the learning of Physics Practicals while 35.1% has positive attitude in the learning of Physics Practicals. Because of the negative and moderate attitude in teaching Practicals that is why most of the respondent don't have knowledge in Physics Practicals

4.3.4 Attitudes on several concerns

Overall students' interaction when teaching in class, Likert-type attitude scale scores were worked out for each of the categories of respondents. The percentages of respondents scoring strongly Disagree, slightly Disagree, Disagreed, Agreed, Slightly Agreed and Strongly Agreed on their attitude were determined. These findings are shown in table 8 below. The students Questionnaire was used to investigate the Attitudes of Students towards Physics Practicals. The attitudinal concerns that were investigated were:

A: Physics practical lessons are difficult to learn
B: Physics Practical teaching is boring
C: I would not like to have more physics practical lessons in school
D: I don't like Physics practical teaching more than the theory teaching
E: I would not do more physics Practicals if I had that opportunity
F: I do not want to hear even the name of Physics Practicals
G: I don't like Physics practical lessons because I decide what to do myself
H: Physics practical lessons are not exciting

Table 8: Attitude of students towards Physics Practical lessons

Do you agree with these views?	Attitude Scored (N = 12)					
	Strongly Disagreed (N, %)	Slightly Disagreed (N, %)	Disagreed (N, %)	Agreed (N, %)	Slightly Agreed (N, %)	Strongly Agreed (N, %)
A	52 (33.8)	1(8.3)	2 (1.3)	36 (23.4)	42(27.3)	10(6.6)
B	35 (22.7)	28(3.9)	30(19.5)	20(13.0)	26(16.9)	15(9.7)
C	16 (10.4)	15(9.7)	15(9.7)	69(44.8)	15(9.7)	36(23.4)
D	19 (12.3)	1(0.6)	15(9.7)	53(34.4)	4(2.6)	19(12.3)
E	19 (12.3)	1(0.6)	15(9.7)	53(34.4)	4(2.6)	62(40.3)
F	68 (44.2)	15(9.7)	32(20.8)	9(5.8)	7(4.5)	23(14.9)
G	99(64.3)	8(5.2)	28(18.2)	4(2.6)	7(4.5)	8(5.2)
H	34(22.1)	14(9.1)	24(15.6)	22(14.3)	41(26.6)	19(12.3)

In order to determine the participating students' attitude towards physical experiments, 8 attitude items were asked to the students. Frequency and percentage values of the replies given by the students for each attitude items are given in Table 8. As shown in Table 8, students who participated in the survey replied to attitude items of answered affirmative questions such as "Physics practical lessons are difficult to learn" 57.3%, "Physics Practical teaching is boring" 39.6%, "I would not like to have more physics practical lessons at school" 77.9%, "I don't like Physics practical lesson more than the theory lesson" 49.3%, "I would not teach more physics Practicals if I had that opportunity" 77.3%, "I do not want to hear even the name Physics Practicals" 25.2%, "I like Physics practical because I decide what to do myself"12.3% and "Physics practical lessons are not exciting" 53.2 % in high rates reported opinions of "strongly Agree" or slightly "Agree" or "Agree". On the other hand, students replied to 8th attitude item reading as "Physics experiments in the physics lessons are boring" was replied opinion of "Strongly Agree" or slightly Agree or "Agree" in range of 44.7% by the participating students. An overall view of the answers of students' regarding their attitudes towards physical experiment, as shown in Table 8, most of the students think that physics experiments are difficult and not easy. Students' attitude scores towards physics experiments were calculated in the same way of the attitude scores towards physics lessons. As a result of this questionnaire with 8 attitude items that could be maximum of 48 points, the average attitude scores towards physics experiments of student was calculated as X = 33.30. In addition, the attitude scores towards physics experiments of students in the lowest 8, highest was 42 points. When it is considered that in generally view to entirely indecisive students the average score attitude scores towards physics experiments should be 33.3, from the statistical results, it can be concluded that students have negative interest and attitude towards physics Practicals, is understood to be high rate of no interest, expectation and unsuccessful in physics experiments. All of the students, even if indecisive, the average score should be around 27. 2, these results shows that students have negative attitude towards physics practical lessons, and also interests in physics classes, is understood to be low expectations and achievement.

4.4. Engagement of Respondents on Physics Practicals

Table 9: Engagement of Teachers on Physics Practicals

Respondent option	Yes		No	
Statements	N	%	N	%
Do You engage in Physics Practical?	05	41.7%	07	58.3%
Do you have a physics Laboratory in your school?	08	66.7%	04	33.3%
Does the physics laboratory in your school contain adequate physics laboratory equipment?	04	33.3%	08	66.7%
If yes, are the equipment in good condition and well-functioning?	02	50.0%	02	50.0%
Do you have somebody else assisting you on Physics practical engagement?	02	16.7%	10	83.3

Among the twelve (12) respondents of teachers, 58.3% said they do not engaged in Physics Practical, 33.3% said they do not have a physics Laboratory in their school, 66.7% said that the physics laboratory in their school do not contain adequate physics laboratory equipment,50% said the that the equipment in not good condition to functioning and 83.3% said they don't have somebody else assisting them in the Physics practical engagement.

Similarly Among the twelve (12) respondents of teachers, 41.7% said they engaged in Physics Practical, 66.7% said they have a physics Laboratory in their school, 33.3% said the physics laboratory in their school contain adequate physics laboratory equipment,50% said that the equipment's are in good condition and 16.7 said they somebody else assisting them in the Physics practical engagement. This result shows that the teachers' engagement in Practicals is poor

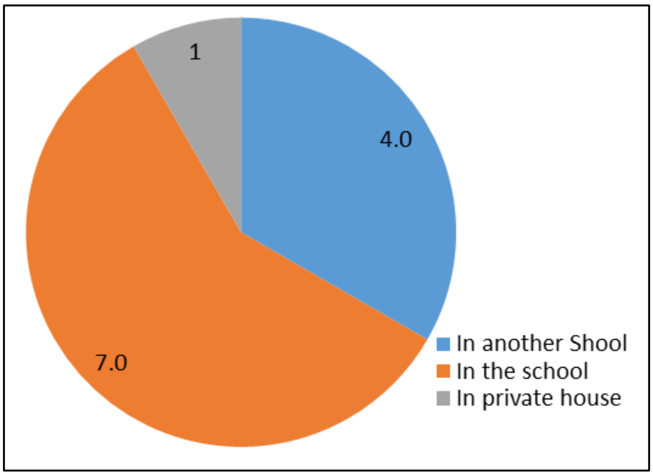

Fig 5: Venue of Engagement of Teachers on Physics Practicals

Among the twelve (12) respondents of teachers, 58.3% said they engaged in Physics Practical in the school, 33.3% said they are engaged in Physics Practical in another school and 8.4% said they are engaged in Physics Practical in their private house.

Table 10: Shows result of pace of students in the learning of physics Practicals, who motivate teachers, when the physics practical engagement is done and how is the practical engagement done

How is your relationship with the students?		
Options	**Frequency**	**Percentage**
Very Good	00	0.0
Good	02	16.7
Satisfactory	07	58.3
Poor	03	25.0
TOTAL	12	100.0
How would you rate the pace of your students in the learning of physics practical?		
Options	**Frequency**	**Percentage**
Too fast	04	33.3
Moderate	02	16.6
Too slow	06	50.0
Total	12	100.0
Who motivates you to engage in physics Practicals?		
Options	**Frequency**	**Percentage**
They students	05	41.7
The school administration	03	25.0
The Governments	00	0.0
No body	04	33.3
Total	12	100.0
When is the physics practical engagement done?		
Options	**Frequency**	**Percentage**
During normal school time	03	25.0
During Weekends	09	75.0
After confidential are out for Practicals	00	0.0
Total	12	100
How is the physics practical engagement done?		
Options	**Frequency**	**Percentage**
By group	07	58.3
By everyone	05	41.7
By individual/privately	00	0.0
Total	12	100.0

Among the twelve (12) respondents of teachers, 58.3% said they are satisfy with the relationship with the students when engaging in Practicals, 25.0 % said their relationship with the students is poor while 16.7 said their relationship with the students is good. 50.0 % of the respondents said they pace of their students in the learning of physics practical is too slow, 33.3 % said they pace of their students in the learning of physics practical is too fast while 16.6% said they pace of their students in the learning of physics practical is moderate. 41.7 % of the respondents said they are motivated by their students to engage in physics practical, 33.3 % said they are not motivated by anybody to engage in physics practical while 25.0% said they are motivated by the school administration to engage in physics practical. 75.0% of the respondents said they are engaged in physics practical during the weekends while 25.0% said they are engaged in physics practical during normal school time and 58.3% of the respondents said the physics practical engagement is done by group while 41.7% said the physics practical engagement is done by everyone.

Table 11: Engagement of Students on Physics Practicals

Respondent option	Yes		No	
Statements	N	%	N	%
Do You engage in Physics Practical?	36	23.4%	118	76.6%
Do you have a physics Laboratory in your school?	112	72.7%	42	27.3%
Does the physics laboratory in your school contain adequate physics laboratory equipment?	36	23.4%	118	76.6%
If yes, are the equipment in good condition and well-functioning?	28	77.7%	08	22.3%
Do you have somebody else assisting you on Physics practical engagement?	55	35.7%	99	64.3

Among the one hundred and fifty four (154) respondents of students, 23.4% said they do not engaged in Physics Practical, 27.3 % said they do not have a physics Laboratory in their school, 76.6% said that the physics laboratory in their school do not contain adequate physics laboratory equipment, 22.3% of those who said the physics laboratory of their schools contain adequate equipment, said the that some of the equipment's are not good in condition and 64.3% said they don't have somebody else assisting their physics teacher in the engagement of Physics practical.

Similarly Among the one hundred and fifty four (154) of students, 23.4 % said they are engaged in Physics Practical, 72.7% said they have a physics Laboratory in their school, 23.4% said the physics laboratory in their school contain adequate physics laboratory equipment,77.7% of those who said that the physics laboratory of their schools contain adequate equipment, said the that some of the equipment's are in good condition and 35.7% said that somebody else assists them in the Physics practical engagement. This result shows that the teachers' engagement in Practicals is poor

Table 12: Shows result of Venue of Engagement of, pace of students in the learning of physics Practicals, who motivate teachers, when is the physics practical engagement done and how is the practical engagement done

Where is the physics practical engagement?		
Options	**Frequency**	**Percentage**
In the school laboratory	43	27.9
In another School Laboratory	18	11.7
Private house Laboratory	09	5.8
Nowhere	84	54.6
Total	154	100.0
How do you assess your physics teacher in terms of physics practical engagement?		
Options	**Frequency**	**Percentage**
Very Good	19	12.3
Good	21	13.6
Satisfactory	30	19.5
Poor	84	54.6
TOTAL	154	100.0
If the physics laboratory is available how frequent does the Physics teacher use it?		
Options	**Frequency**	**Percentage**
Only during practical lesson	84	75.0
At all time	22	19.6
Never use the laboratory	06	5.4
Total	112	100.0
If the practical lessons engagement is not done in the school laboratory, why?		
Options	**Frequency**	**Percentage**
Because we don't have accesses to the laboratory	15	13.5
Because the materials are not readily available	07	6.3
Because the laboratory has no adequate materials	84	75.7
Because there is no laboratory technician to assist	05	4.5
Total	111	100.0
How is your relationship with the Physics practical teacher?		
Options	**Frequency**	**Percentage**
Very good	04	2.6
Good	33	21.4
Satisfactory	80	51.9
Poor	37	24.1
Total	154	100.0

How would you rate the pace of physics practical delivery of the Physics practical teacher?		
Too fast	25	35.7
Moderate	40	57.1
Moves with every student	05	7.2
Total	70	
Who motivates you to engage in physics Practicals?		
Options	**Frequency**	**Percentage**
They teacher	30	42.9
The school administration	23	32.9
The Governments	00	0.0
No body	17	24.2
Total	70	100.0
When is the physics practical engagement done?		
Options	**Frequency**	**Percentage**
During normal school time	18	11.7
During Weekends	52	33.8
After confidential are out for Practicals	84	54.5
Total	154	100
How is the physics practical engagement done?		
Options	**Frequency**	**Percentage**
By group	44	62.9
By everyone	23	32.9
By individual/privately	03	4.2
Total	70	100.0

Among the one hundred and fifty four (154) respondents of students, 57.6% said they are not engaged in physics Practicals anywhere, 27.9 % said they are engaged in physics Practicals in their schools, 11.7% said they are engaged in physics Practicals in another schools while 54.6 % said they are not engage in physics practical anywhere as a result they have not done physics Practicals. 54.6% of the respondents said their engagement with their physics practical teacher is poor, 19.5% said their engagement with their physics practical teacher is satisfactory, 13.6% said their engagement with their physics practical teacher is good while 12.3% said their engagement with their physics practical teacher is very Good. This assessment of students is done base on performing experiment. For the respondent that say they are engage in physics Practicals 75% said they only used the laboratory during practical lessons, 19.6% said they always used the laboratory at all-time and 5.4% said they have never used their own school laboratory. For the respondents that say they are not engage in Physics Practicals in their schools, 75.7% said they don't engage in physics practical in their schools because the laboratory has no adequate materials, 13.5% said they don't engage in physics practical in their schools because they don't have accesses to the laboratory, 6.3% said they don't engage in physics practical in their schools because the materials are not readily available and 4.5% said they don't engage in physics practical in their schools because there is no laboratory technician to assist. 51.9 % of the respondents said they are satisfy with the relationship with the teacher when engaging in Practicals, 24.1 % said their relationship with the teacher is poor, 21.4% said their relationship with the teacher is good while 2.6% very said their relationship with the teacher is good. Out of the seventy (70) respondent that say they are engage in physics Practicals, 57.1% said they pace of their teacher in the teaching of physics practical is moderate, 35.7 % said they pace of their teacher in the teaching of physics practical is too fast while 7.2% said they pace of their teachers in the teaching of physics practical is moderate. Also out of the seventy (70) respondents who say they are engage in physics Practicals, 42.9 % of the respondents said they are motivated by their teachers to engage in physics practical, 32.9 % said they are motivated by the school administration to engage in physics while 24.2% said they are not motivated by anybody to engage in physics practical. Out of the one hundred and fifty four (154) respondents 54.5% said they would only engage in physics Practicals when confidential are out for physics Practicals, 33.8% of the respondents said they are engaged in physics practical during the weekends while 11.7% said they are engaged in physics practical during normal school time. Finally, out of the seventy (70) students who engage in physics Practicals, 62.9% of the respondents said the physics practical engagement is done by group, 32.9% said the physics practical engagement is done by everyone 4.2% said the engagement is done by individual.

4.5. Effectiveness of Physics Practicals

4.5.1 Effectiveness of Teaching Physics Practicals

Overall teacher's interaction when teaching in class, Likert-type attitude scale scores were worked out for each of the categories of respondents. The percentages of respondents scoring strongly Disagree, Disagreed, Agreed and Strongly Agreed on their attitude were determined. These findings are shown in table 1. The teachers Questionnaire was used to investigate the Effectiveness of Teaching Physics Practicals. The Effectiveness concerns that were investigated were:

A: I teach Physics practical using the experimental approach of investigation by every student

B: Introduction to physics Practicals concept is taught

C: Setting up of the apparatus is done by me

D: Interpretation of laboratory manual/ questions paper is done by me

E: Reading from experiment and tabulation is done by me

F: Analysis of data from Practicals are done by me

G: Practical procedures are done by me

H: Practical work evaluation are done by me after every practical conducted

I: Practical demonstration is done all times
J: Each practicum demonstration is one hour
K: We have four hours weekly for Practicals engagement
L: I write readings on the black board and students copy from the black board
M: I do not miss any physics practical lessons lesson

Table 13: Respondents of Teachers on the Effectiveness of Physics Practical

Do you agree with these views?	Strongly Disagreed (N, %)	Disagreed (N, %)	Agreed (N, %)	Strongly Agreed (N, %)
A	4(33.3)	6(50.0)	1(8.3)	1(8.3)
B	7(58.3)	1(8.3)	3(25.0)	1 (8.3)
C	7(58.3)	3(25.0)	1(8.3)	1(8.3)
D	9 (75.0)	2(16.7)	1(8.3)	0(0.0)
E	4 (33.3)	1(8.3)	5(41.7)	2(16.7)
F	6 (50.0)	5(41.7)	0(0.0)	1(8.3)
G	5(41.7)	4(33.3)	2(16.7)	1(8.3)
H	7(58.3)	2(16.7)	1(8.3)	2(16.7)
I	1(8.3%)	2(16.7%)	3(25.0%)	6(50.0%)
J	4(33.3)	1(8.3)	3(25.0%)	4(33.3%)
K	12(100.0)	0(0.0)	0(0.0)	0(0.0)
L	2(16.7)	1(8.3)	5(41.7)	4(33.3)
M	0(0.0)	1(8.3)	5(41.7)	6(50.0)

In order to determine the participating teachers' on the Effectiveness of Physics Practical, 13 attitude items were asked to the teachers. Frequency and percentage values of the replies given by the teacher for each items are given in Table 13. As shown in Table 13, teachers who participated in the survey replied to attitude items of answered affirmative questions such as *"*I teach Physics practical using the experimental approach of investigation by every student*"* 16.6%, *"*Introduction to physics Practicals concept is taught*"* 33.3%, *"*Setting up of the apparatus is done by me*"* 16.6%, *"*Interpretation of laboratory manual/ questions paper is done by me*"* 8.3%, Reading from experiment and tabulation is done by me 58.4%, Analysis of data from Practicals are done by me 8.3% Practical procedures are done by me*"25.0%* , ''Practical work evaluation are done by me after every practical conducted'' 25.0%, *'*'Practical demonstration is done only when confidential are out''75.0% , '' Each practicum demonstration is one hour 58.3%, '' We have four hours weekly for Practicals engagement 0.0%, ''I write readings on the black board and students copy from the black board'' 75.0% and '' I do not miss any physics practical lessons lesson'' 91.7% all in high rates reported opinions of "strongly Agree" or "Agree".

On the other hand, teachers replied to 13th attitude item reading as *'*'I teach Physics practical using the experimental approach of investigation by every student*"* 83.4%, *"*Introduction to physics Practicals concept is taught*"* 66.7%, *"*Setting up of the apparatus is done by me*"* 83.4%, *"*Interpretation of laboratory manual/ questions paper is done by me*"* 91.7%, Reading from experiment and tabulation is done by me 41.6%, Analysis of data from Practicals are done by me 8.3% Practical procedures are done by me*"75.0%* , ''Practical work evaluation are done by me after every practical conducted'' 75.0%, *'*'Practical demonstration is done only when confidential are out''25.0% , '' Each practicum demonstration is one hour 41.7%, '' We have four hours weekly for Practicals engagement 100.0%, ''I write readings on the black board and students copy from the black board'' 25.0% and '' I do not miss any physics practical lessons lesson'' 8.3% all in high rates reported opinions of all in high rates reported opinions of "strongly Disagreed or Agree"

As a result of this questionnaire with 13 attitude items that could be maximum of 52 points, the average attitude scores towards physics experiments of student was calculated as X = 48.8%. In addition, the attitude scores towards the effectiveness of physics experiments of teachers in the lowest 8, highest was points. When it is considered that in generally view to entirely indecisive teachers, the average score of the effectiveness scores towards the effectiveness of physics experiments should be 26, from the statistical results, it can be concluded that teachers are not effective in the teaching of physics Practicals.

4.5.2 Effectiveness of Learning Physics Practicals

Overall student's interaction when learning in class, Likert-type attitude scale scores were worked out for each of the categories of respondents. The percentages of respondents scoring strongly Disagree, Disagreed, Agreed, and Strongly Agreed on their attitude were determined. These findings are shown in table 14. The Students Questionnaire was used to investigate the Effectiveness of Learning Physics Practicals. The Effectiveness concerns that were investigated were:
A: We are taught Physics practical using the experimental approach of investigation by every student
B: Introduction to physics Practicals concept is taught before we start to demonstrate practical
C: Setting up of the apparatus is done by us
D: Interpretation of laboratory manual/ questions paper is done by us
E: Reading from experiment and tabulation is done by me
F: Analysis of data from Practicals are done by the teacher
G: Practical procedures are done by us
H: Practical work evaluation are done by the teacher after every practical conducted
I: Practical demonstration is done only when confidential are out
J: Each practicum demonstration is one hour
K: We have four hours weekly for Practicals engagement
L: We only readings from the black board
M: I do not miss any physics practical lessons lesson

Table 14: Respondents of Students on the Effectiveness of Physics Practical

Do you agree with these views?	Strongly Disagreed (N, %)	Disagreed (N, %)	Agreed (N, %)	Strongly Agreed (N, %)
A	35(22.7)	63(40.9)	37(24.0)	19(12.3)
B	35(22.7)	63(40.9)	44(28.6)	12 (7.8)
C	27(17.5)	50(32.5)	49(31.8)	28(18.2)
D	30 (19.5)	64(41.6)	41(26.6)	19(12.3)
E	29(18.8)	54(35.1)	54(35.1)	17(11.0)
F	27(17.5)	61(39.6)	46(29.9)	20(13.0)
G	34(22.1)	64(41.6)	46(29.9)	10(6.5)
H	26(16.9)	61(39.6)	49(31.8)	18(11.7)
I	21(13.6)	73(47.4)	43(27.9)	17(11.0)
J	4(33.3)	1(8.3)	3(25.0)	4(33.3)
K	19(12.3)	74(48.1)	36(23.4)	25(16.2)
L	26(16.9)	78(50.6)	49(31.8)	1(0.6)
M	36(23.4)	53(34.4)	29(18.8)	36(23.4)

In order to determine the participating students' on the Effectiveness of Physics Practical, 13 attitude items were asked to the students. Frequency and percentage values of the replies given by the students for each items are given in Table 14. As shown in Table 14, student who participated in the survey replied to attitude items of answered affirmative questions such as *"I learn Physics practical using the experimental approach of investigation by every student"* 36.3%, *"Introduction to physics Practicals concept is taught before practical work start" 36.4*%, *"Setting up of the apparatus is done by us"* 50.0%, *"Interpretation of laboratory manual/ questions paper is done by us"* 38.9%, Reading from experiment and tabulation is done by us 46.1%, Analysis of data from Practicals are done by us 42.9% Practical procedures are done by us*"36.4%* , ''Practical work evaluation are done by the teacher after every practical conducted'' 43.5%, *'*'Practical demonstration is done only when confidential are out''38.9.0% , '' Each practicum demonstration is one hour 58.3%, '' We have four hours weekly for Practicals engagement 39.4%, '' we the students copy from the black board'' 32.4% and '' the teacher does not miss any physics practical lessons lesson'' 42.5% all in high rates reported opinions of "strongly Agree" or "Agree". On the other hand, teachers replied to 13th attitude item reading as *"I learn Physics practical using the experimental approach of investigation by every student"* 63.6%, *"Introduction to physics Practicals concept is taught before practical work start"* 63.6%, *"Setting up of the apparatus is done by us"* 50.0%, *"Interpretation of laboratory manual/ questions paper is done by us"* 61.1%, Reading from experiment and tabulation is done by us 53.9%, Analysis of data from Practicals are done by us 57.1% Practical procedures are done by us*"63.1%* , ''Practical work evaluation are done by the teacher after every practical conducted'' 56.5%, *'*'Practical demonstration is done only when confidential are out''61.0% , '' Each practicum demonstration is one hour 41.6%, '' We have four hours weekly for Practicals engagement 60.4%, '' we the students copy from the black board'' 67.5% and '' the teacher does not miss any physics practical lessons lesson'' 57.8% all in high rates reported opinions of "strongly Disagreed or Agree" As a result of this questionnaire with 13 attitude items that could be maximum of 52 points, the average attitude scores towards physics experiments of student was calculated as X = 50.0%. In addition, the attitude scores towards the effectiveness of physics experiments of teachers in the lowest 8, highest was 52 points. When it is considered that in generally view to entirely indecisive teachers, the average score of the effectiveness scores towards the effectiveness of physics experiments should be 25, from the statistical results, it can be concluded that students are not effective in the learning of physics Practicals.

4.6. Factors Affecting the Effectiveness of Physics Practicals

4.6.1 Factors Affecting the Effectiveness of Teaching Physics Practicals

Table 12: Shows result the perception of teacher on students in the learning of physics Practicals and who conduct the physics Practicals

Table 15: Respondents of Teachers on the perception of student on Practicals and who conduct it

What perception do your students have about physics Practicals?		
Options	**Frequency**	**Percentage**
More difficulty than the theory	07	58.3
It Abstract	00	0.0
like Mathematics	02	16.7
Easy	03	25.0
Total	12	100.0
Who conduct the physics Practicals?		
Options	**Frequency**	**Percentage**
Lab technician	00	0.0
Our physics teacher	04	33.3
Another teacher in the school	02	16.7
Another teacher from another school	07	50.0
Total	12	100.0

Among the twelve (12) respondents of teachers, 58.3 % said the perception of physics Practicals of students is that it is more difficulty than the theory, 25.0% said the perception of physics Practicals of students is that it is easy and 16.7% said the perception of physics Practicals of students is that physics practical is like mathematics. Among this same respondents, 50.0% said that the physics practical is conducted by another teacher from another school, 33.3% said they conduct the Practicals and 16.7% said the practical is conducted by another teacher in the same school

Overall teacher's interaction when teaching in class, Likert-type attitude scale scores were worked out for each of the categories of respondents. The percentages of respondents scoring strongly Disagree, Disagreed, Agreed and Strongly Agreed on their attitude were determined. These findings are shown in table 16. The teachers Questionnaire was used to investigate the factors affecting the Effectiveness of Teaching Physics Practicals. The Factors Affecting the Effectiveness concerns that were investigated were:

A: Physics Practicals is more difficulty to teach than the theory

B: Am motivated to teach physics Practicals

C: I have enough time to engage in Practicals

D: We have an equipped laboratory

E: I have many students in class

F: I have a trained and qualified Lab technician that helps me in the demonstration of physics Practicals teacher

G: We assess students on physics Practicals during internal exams

H: Am guiding and introducing students on physics Practicals concept

I: Am motivated by the school heads to teach Physics

Practicals
J: Each practicum demonstration is one hour
K: I have enough time to engage in Practicals
L: I write readings on the black board and students copy from the black board
M: I am trained and qualify to teach Practicals
N: I am an examiner in physics Practicals
O: The training I got in university is adequate enough for me to handle the whole physics Practicals
P: Am engaged in another school
Q: Am not a pin coded teacher
R: Am not motivated by anybody or organization

Table 16: Respondents of Teachers on the factors affecting the Effectiveness of Physics Practical

Do you agree with these views?	Strongly Disagreed (N, %)	Disagreed (N, %)	Agreed (N, %)	Strongly Agreed (N, %)
A	4(33.3)	1(8.3)	3(25.0)	4(33.3)
B	4(33.3)	2(16.7)	4(33.3)	2(16.7)
C	5(41.7)	1(8.3)	2(16.7)	4(33.3)
D	5 (41.7)	3(25.0)	3(25.0)	1(8.3)
E	5 (41.7)	6(50.0)	0(0.0)	1(8.3)
F	7 (58.3)	5(41.7)	0(0.0)	0(0.0)
G	7(58.3)	5(41.7)	0(0.0)	0(0.0)
H	6(50.0)	3(25.0)	1(8.3)	2(16.7)
I	7(58.3%)	3(25.0)	2(16.7)	0(0.0)
J	2(16.7)	4(33.3)	4(33.3)	2(16.7)
K	10(83.3)	2(16.7)	0(0.0)	0(0.0)
L	5(41.7)	1(8.3)	2(16.7)	4(33.3)
M	8(66.7)	2(16.7)	1(8.3)	1(8.3)
N	9(75.0)	3(25.0)	0(0.0)	0(0.0)
O	8(66.7)	3(25.0)	1(8.3)	0(0.0)
P	7(58.3)	1(8.3)	1(8.3)	4(33.3)
Q	2(16.7)	1(8.3)	3(25.0)	6(50.0)
R	0(0.0)	1(8.3)	5(41.7)	6(50.0)

In order to determine the participating teachers' on the factors affecting the Effectiveness of Physics Practical, 17 attitude items were asked to the teachers. Frequency and percentage values of the replies given by the teacher for each items are given in Table 13. As shown in Table 13, teachers who participated in the survey replied to attitude items of answered affirmative questions such as *"*Physics Practicals is more difficulty to teach than the theory*"* 58.3%, *"*Am motivated to teach physics Practicals *"* 50.0%, "I have enough time to engage in practical's*"* 50.0%, "We have an equipped laboratory*"* 33.3%, I have many students in class 8.3%, I have a trained and qualified Lab technician that help me in the demonstration of physics Practicals teacher*"0.0%,* '' We assess students on physics Practicals during internal exams '' 0.0%, *''* Am guiding and introducing students on physics Practicals concept''25.0% , '' Am motivated by the school heads to teach Physics Practicals 50.0%, '' The Practicals helps in understanding the theory 0.0%, 'I have enough time to engage in Practicals, '' 50.0% I know how to operate the equipment's in the laboratory 50.0%, I am trained and qualify to teach Practicals 16.6%, I am an examiner in physics Practicals 0.0%, The training I got in university is adequate enough for me to handle the whole physics practical's 8.3% Am engaged in another school 41.6%, Am Not a pin coded teacher 75.0% and '' Am not motivated by anybody or organization' 91.7% all in high rates reported opinions of "strongly Agree" or "Agree".

On the other hand, teachers replied to 13th attitude item reading as *"*Physics Practicals is more difficulty to teach than the theory*"* 41.7%, *"*Am motivated to teach physics Practicals *"* 50.0%, "I have enough time to engage in practical's*"* 50.0%, "We have an equipped laboratory*"* 66.7%, I have many students in class 91.7%, I have a trained and qualified Lab technician that help me in the demonstration of physics Practicals teacher*"100.0%* , '' We assess students on physics Practicals during internal exams '' 100.0%, *''* Am guiding and introducing students on physics Practicals concept''75.0% , '' Am motivated by the school heads to teach Physics Practicals 50.0%, '' The Practicals helps in understanding the theory 100.0%, 'I have enough time to engage in Practicals, '' 50.0% I know how to operate the equipment's in the laboratory 50.0%, I am trained and qualify to teach Practicals 83.4%, I am an examiner in physics Practicals 100.0%, The training I got in university is adequate enough for me to handle the whole physics practical's 91.7% Am engaged in another school 58.4%, Am Not a pin coded teacher 25.0% and '' Am not motivated by anybody or organization' 8.3% all in high rates reported opinions of "strongly Disagreed or Agree"

As a result of this questionnaire with 17 attitude items that could be maximum of 68 points, the average attitude scores towards physics experiments of student was calculated as X = 41.0%. In addition, the attitude scores towards the effectiveness of physics experiments of teachers in the lowest 8, highest was points. When it is considered that in generally view to entirely indecisive teachers, the average score of the effectiveness scores towards the effectiveness of physics experiments should be 31, from the statistical results, it can be concluded that teachers are not effective in the teaching of physics Practicals.

4.5.2 Factors affecting the Effectiveness of Learning Physics Practicals

Overall student's interaction when learning in class, Likert-type attitude scale scores were worked out for each of the categories of respondents. The percentages of respondents scoring strongly Disagree, Disagreed, Agreed, and Strongly Agreed on their attitude were determined. These findings are shown in table 14. The Students Questionnaire was used to investigate on the factors affecting the Effectiveness of Learning Physics Practicals. The factors affecting the Effectiveness of physics practical learning concerns that were investigated were:
A: Physics Practicals is more difficulty to learn than the theory
B: Am motivated to learn physics Practicals
C: I have enough time to engage in Practicals
D: We have an equipped laboratory
E: We are many in class
F: W have a trained and qualified Lab technician that helps the Practicals teacher in the demonstration of physics
G: We are assessed on physics Practicals during internal exams
H: We are introduced students on physics Practicals concept
I: Am motivated to learn Physics Practicals
J: Each practicum demonstration is one hour
K: I have enough time to engage in Practicals
L: The practical helps us in understanding the theory

Table 14: Respondents of Students on the Effectiveness of Physics Practical

Do you agree with these views?	Strongly Disagreed (N, %)	Disagreed (N, %)	Agreed (N, %)	Strongly Agreed (N, %)
A	26(16.9)	70(45.5)	41(26.6)	17(11.0)
B	21(13.6)	55(35.7)	43(27.9)	35(22.7)
C	13(8.4)	64(41.6)	54(35.1)	23(14.9)
D	32 (20.8)	43(27.9)	49(31.8)	30(19.5)
E	22(14.3)	61(39.6)	46(29.9)	25(16.2)
F	51(31.1)	43(27.9)	34(21.1)	26(19.9)
G	94(60.0)	60(40.0)	0(0.0)	0(0.0)
H	54(35.1)	40(26.1)	42(27.3)	18(11.7)
I	11(7.1)	54(35.1)	53(34.4)	36(23.4)
J	15(9.8)	61(39.6)	45(29.2)	33(21.4)

In order to determine the participating students' on the Effectiveness of Physics Practical, 10 attitude items were asked to the students. Frequency and percentage values of the replies given by the students for each items are given in Table 14. As shown in Table 14, student who participated in the survey replied to attitude items of answered affirmative questions such as *"*Physics Practicals is more difficulty than the theory*"* 37.6%, *"*Am motivated to learn physics Practicals *50.6*%, "I have enough time to engage in Practicals practical's *"* 50.0%, *"*We have an equipped laboratory*"* 51.3%, We are many in class 46.1%, We have a trained and qualified Lab technician that help the physics teacher*"41.0%*, We are assessed on physics Practicals during internal exams 0.0%, 'We are introduced and guided on the concept of physics Practicals 39.0%, '' We are encourage to do Practicals 57.8%, '' and The Practicals helps us in understanding the theory' 50.6 % all in high rates reported opinions of "strongly Agree" or "Agree". On the other hand, teachers replied to 13th attitude item reading as *""*Physics Practicals is more difficulty than the theory*"* 62.4%, *"*Am motivated to learn physics Practicals *49.4*%, *"*I have enough time to engage in Practicals practical's *"* 50.0%, "We have an equipped laboratory*"* 48.7%, We are many in class 53.9%, We have a trained and qualified Lab technician that help the physics teacher*"59.0%* , We are assessed on physics Practicals during internal exams ' 100.0%, 'We are introduced and guided on the concept of physics Practicals 61.0%, '' We are encourage to do Practicals 42.2%, '' and The Practicals helps us in understanding the theory' 49.4 % in high rates reported opinions of "strongly Disagreed or Agree"

As a result of this questionnaire with 10 attitude items that could be maximum of 40 points, the average attitude scores towards physics experiments of student was calculated as X = 32.8%. In addition, the attitude scores towards the factors affecting the effectiveness of physics experiments of students in the lowest 8, highest was 40 points. When it is considered that in generally view to entirely indecisive teachers, the average score of the effectiveness scores towards the effectiveness of physics experiments should be 21.0 from the statistical results, it can be concluded that students are not effective in the learning of physics Practicals.

5. Summary, Conclusion and Recommendations

The previous chapter reveals the result of the research questionnaires and discussed them as they were asked. The results were presented in tables and graph for better understanding of the study. Based on the results and discussions in chapter four (4) and what all other chapters have emphasized, this chapter is intended to give a summary of finding, a concluding statement based on the findings from the study and appropriate strategies recommended for the Impact of Physics Practical's on the Teaching and Learning of Senior Secondary Schools Physics in Selected School in Bo City.

5.1. Summary

The preceding discussion illustrate beyond all reasonable doubt that physics Practicals has an impact on the teaching and learning of physics. If the impact of physics practical on the teaching and learning of physics is not known, then the teaching and learning of physics becomes difficult. The findings and observations are presented below:

The following observations were made by the researcher in the study area.

5.1.1 Demographic Characteristics

- The finding revealed that, all the physics practical teachers are male and most of them are adults whose ages range from 28 – 49 years and 50% of them are more than 50 years old. They are also highly experienced. It is also clear that only one of the physics practical teachers has a Bachelor of Science Degree in Physics. Other with degree did related science course. Majority of the respondent teacher do not have pin code and as a result are either voluntary teachers or part term teachers.
- The finding also revealed that, 50.6% of the students attended mixed school while 49.4% attended co-educational schools. Majority of the student's respondent are male. This shows that more male offer physic as a subject than female. Most of the student respondents are teenagers and they are in SSS3. Most of the respondents are admitted in SSS1 and have gone through many internal exams and their guardian have attained Tertiary education in English Education

5.1.2 Knowledge of Respondents on Physics Practicals

- The finding revealed that all the physics teacher respondents have had of the term physics Practicals, are knowledgeable in:- identifying Physics apparatus, general types of Physics Practicals, types of Physics Practicals for WASSCE purpose and using correct units, knowledgeable in collecting data from an experiment, knowledgeable in: - different parts of a graph to be plotted, reading of instruments and labelling of diagrams but their knowledge of teaching physics practical
- The finding also revealed that majority respondents of teachers are not knowledgeable in:- applying the right materials /equipment, Penalties on wrong plotting of graphs, knowledgeable in:- setting up an experiment, interpreting diagrams, planning for an experiments, measuring correctly with correct precision, recording

readings obtained from an experiment, construction of composite table, reading the question paper or manual and interpreting it, choosing correct scale of a graph and organizing students for practical's and presenting data from experiments, investigations, or simulations. This result shows that the teachers are not knowledgeable enough to teach physics Practicals.

- The finding revealed that majority of the student's respondents are knowledgeable in using correct units and different parts of a graph, in the types of Physics Practicals and types of Physics Practicals for WASSCE, knowledgeable in observing safety rules in the laboratory and identification of some of the physics practical apparatus. But however
- The finding also revealed that Majority of students respondents said they are not knowledgeable in the rules and regulations on physics Practicals, organizing there colleague students for practical's, construction of a composite table, presenting data from experiments, investigations, or simulations, interpreting of laboratory manual or question paper and reading of instruments, Penalties on wrongly plotting of graph, applying right materials /equipment and in stating precautions, following instructions and demonstrating the activities of the instruction and plotting graph. They are also not knowledgeable in the determination of slope and intercept, choosing correct scale and in interpreting physics practical result correctly, right mathematical foundation and in recording readings obtained from an experiment, analyzing data correctly, interpreting diagrams, setting up an experiment, planning for an experiment and reading the question paper or manual and interpreting it. This result shows that majority of the students targeted are not knowledgeable enough in physics practical's.

5.1.3 Attitude towards Physics Practicals

- The study revealed that some teachers have negative or Moderate/average attitude in the teaching of Physics Practicals while few has positive attitude in the teaching of Physics Practicals. Because of the negative and moderate attitude in teaching Practicals that is why most of the respondent doesn't have knowledge in Physics Practicals. Their responses show that they have more negative attitude than positive attitude in the teaching of physics Practicals.
- The study revealed that some students have positive or Moderate/average attitude in the learning of Physics Practicals while few has negative attitude in the learning of Physics Practicals. Because of the marks allocated in the public examination respondent have no alternative but to make it a priority in doing Physics Practicals. This is because most students intend to purse applied sciences courses in the university which requires physics.

5.1.4 Engagement of Respondents on Physics Practicals

- The study revealed that some teachers are not engaged in Physics Practical, physics laboratory in their school do not contain adequate physics laboratory equipment, the equipment are not in good condition to functioning and don't have somebody else assisting them in the Physics practical engagement. This result shows that the teachers' engagement in physics Practicals is poor. The result also shows that the teachers are satisfy with the relationship with the students when engaging in Practicals and the pace of their students learning physics is slow. They teachers have limited time in engaging in practical since Practicals are not plotted on they normally school time table. This gives them extra borden.
- The study revealed that majority of the students are not engaged in Physics Practical, physics laboratory in their school do not contain adequate physics laboratory equipment, the equipment are not in good condition to functioning and don't have somebody else assisting them in the Physics practical engagement. This result shows that these students engagement in physics Practicals is poor. The result also shows that the students are not satisfy with the relationship with their teachers in term of engaging in Practicals and the pace of their teacher teaching physics Practicals. They students also have limited time in engaging in practical since Practicals are not plotted on their normal school time table.

5.1.5 Effectiveness of Respondents on Physics Practicals

- The study revealed that the teaching of physics Practicals by teachers is not effective. This is because most teachers don't teach the concept of Introduction to physics Practicals, were the teacher explain the concept of Interpretation of laboratory manual/ questions paper, Setting up of the apparatus, obtaining result, tabulation of result and analysis of result. It is also not effective because most of the work is done by teacher and in the case were the student does the experiment they are not evaluated.
- The study also revealed that the learning of physics Practicals by the students is not effective. This is because most of the practical work is done by the teacher and the students only copy the result obtained by the teacher. Even in the case were results are obtained by the student, they cannot effectively analysis since majority students lack the foundation of mathematical skill need for the analysis. The time allocated for physics practical is not conducive since it is mostly done on week end and not on the regularly time table.

5.1.6 Factors for the Effectiveness of Physics Practicals

- The study revealed that there are many factors affecting the teaching of physics Practicals. Some of the factors are:- the knowledge of teachers on physics Practicals is inadequate, the willingness of the teachers to teach physics Practicals, no laboratory technician, not indicated on the regular time table, teachers are not motivated, non-availability of apparatus, large number of students.
- The study also revealed that there are many factors affecting the learning of physics Practicals by the students. Some of the factors are:- they are not knowledgeable in setting up an experiment, they are not motivated to engage in physics Practicals, not indicated on the regular time table. They are not assessed internally on physics Practicals, they don't have access to the laboratory, they are not guarded and they are not introduced to Practicals.

5.2. Conclusion

From the result physics practical has an impact on the teaching and Learning of senior secondary school physics. This is as a result it increases the knowledge of teachers and student on physics, gives positive attitude to teachers and students and help to verify the theories in physics. This will also help the teacher and students to used theoretical concept in physics to design instrument which could be used in the environment. Hence it will increase the interest of the teachers and students on the teaching and Learning of senior secondary school physics.

5.3 Recommendations

Based on the conclusions of this survey, the following recommendations were made to aid the appropriate teaching and Learning of senior secondary school physics Practicals.

Finally, based on the findings of the study, the researcher forwards the following recommendations:

- Female students should be encouraged in physics learning through exposure to more physics practical exercises.
- Manageable number of students should be allocated to a class for an optimum performance.
- Government should provide more practical equipment that will go round the students and ensure student's teacher ratio that will enhance interaction for acquisition of practical skills
- Physics teachers should be professionals and holders of Bachelor of Science Education in physics.
- Each town must have a well-equipped physics laboratory to be used by Every school in that town which will be used at a periodic time.
- Teachers should be adequately sensitized on the importance of physics practical.
- Government should make available Instructional aides.
- Regular supervision should be carried out in schools to ensure practical work is implemented.
- That teachers should use the practical approach in the teaching of the subject because it leads to acquisition of science skills, enhance student's understanding and eventually, better student's performance in the subject. In addition, practical approach to the teaching of the subject leads to the development of positive attitude towards the subject.
- That school administration and the Boards of management should equip physics laboratory since the practical approach to teaching the subject demands such facility.
- That school authorities should employ enough trained and quality teachers to tach physics practical in the school taking into account the teacher-pupils ratio for better understanding.
- Students should be properly taught how to perform experiment, represent data, analysis data in a form of a topic know as introduction to Physics Practicals before the engagement of the practical itself
- A syllabus show be design on what Practicals that should be done at every level of the student
- Assessment of student on the practical in the internal examination must be enforced
- In as much as science is the gate way to development of any nation MBSSE should give high preference to science by recruiting more trained and qualified teachers and laboratory technicians
- There should be professional development activities for secondary school physics teachers organized by MBSSE, NGOs, or by any concerned bodies.
- The government and stakeholders should increase the attractiveness of a career in physics teaching. For physics teachers to remain both inspired and inspiring they need to be given the support and opportunity to remain up to date.
- There should be on line workshops and seminars for the secondary school physics practical teachers in order to update them, and also there should be an online physics practical tutorial written for secondary school physics students.
- Teachers and school support staff have to be trained in producing improvised instructional devices using raw materials available in school locality.

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