UNIVERSITY OF EDUCATION, WINNEBA

BIOLOGY TEACHERS' KNOWLEDGE, ATTITUDE AND USE OF LABORATORY PRACTICES OF LEARNER-CENTERED TEACHING TECHNIQUES IN JIRAPA MUNICIPALITY

GIFTY BAYELDENG

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DECLARATION

STUDENT'S DECLARATION

I, GIFTY BAYELDENG, declare that this dissertation, with exception of quotations and references contain in publish works which have all been identified and acknowledge. I hereby declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

SIGNATURE: ……..…….

DATE: ……

SUPERVISOR'S DECLARATION

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

DR. JAMES AWUNI AZURE (SUPERVISOR)

SIGNATURE: …..……

DATE: ……. ……

DEDICATION

Dedicated to GOD Almighty, for his protection and guidance during my studies. This study is dedicated also to Bayeldeng family, FMM family, Dapilah family, Ballans family, Bawa family, Mwinyogle family, Kpankpari family and all people of good will.

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I give glory and honour to God for all His blessings. My deepest appreciation and profound gratitude to my Supervisor, Dr. Azure James Awuni for his patience, invaluable advice, encouragement and expert guidance throughout the process of my dissertation.

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May God richly bless you all!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

LCTT	Learner-Centered Teaching Techniques
SHS	Senior High Schools
SPSS	Statistical Packages for Social Sciences
WAEC	West African Examinations Council

ABSTRACT

The study aimed to explore Biology Teachers' Knowledge, Attitude and use of laboratory practices of learner-centered teaching techniques in Jirapa Municipality. The survey design was adopted for the study. Four SHSs in the municipality with a sample population of 37 biology teachers were purposively sampled for the study. Questionnaires were the main instrument adopted for data collection. Descriptive statistic was used to analyze the data. Observations were made during practical lessons conducted by a biology teacher from St. Francis Girls' SHS and another from Ullo SHS. Descriptive statistics were used to analyse the data. The study revealed that teachers carried out practical lessons for students and gave clear explanation before students performed practical work. The knowledge level of Biology teachers in organising practical work was high, which moderately influenced their attitudes toward practical work. It is recommended that Senior High School Biology teachers in the Jirapa Municipality should make botanical gardens in their schools and should organise field trips to enhance teaching and learning. Again, Senior High School Biology teachers in the Jirapa Municipality should make students perform practical work in groups and then individual, train students to perform practical work within stipulated time, mark student's practical work and provide immediate feedback. This will make students do their corrections and perform better in Biology practical examinations. Notwithstanding, Ministry of Education, Jirapa Municipal Education office should launch science education project in the study area which focuses on school laboratory establishment and facility fulfilling as well as enhancing knowledge and skills of biology teachers. Lastly, a great awareness on the importance of biology science education has to be given to female students by role model professionals, educational structural organizations and science teachers.

CHAPTER ONE

INTRODUCTION

1.0 Overview

The chapter discusses the background to the study, statement of the problem, purpose of the study, research objectives, research questions, significance of the study, delimitation of the study, limitations and the organisation of the study.

1.1 Background to the Study

The study sought to examine Biology teachers' knowledge, attitude and use of laboratory practices of learner-centered teaching techniques in Jirapa Municipality. Biology is an important subject to teach and understand since it aids in increasing people's quality of life and tackling a variety of societal issues such as health, food storage, crop production, and environmental conservation. Furthermore, knowledge about natural and environmental concepts, principles, theories, and laws is aided by the knowledge, abilities, and attitudes gained via biology education (Annan & Yawson, 2019). Still, biology knowledge is necessary for several fields of study that contribute significantly to the nation's technological advancement (Ahmed, Saaem, Wu, & Brown, 2014). In order to make meaningful decisions and solve problems, biology should be taught in a way that guides the learner and develops critical thinking skills. Without real use of laboratory practices, this will not be possible. Mwangu and Sibanda(2017) consider the importance of biology laboratory practical lessons in understanding biological principles. Biology Science education serves a significant role to any country's economic, medical and technological development. Still, biology knowledge is necessary for several fields of study that contribute significantly to the nation's technological advancement. Many senior high school science teachers regard biology as one of the most difficult subjects they have ever

taught. Biology is an isolated discipline because biology teachers regard the laboratory practice to be isolated, with only sporadic linkages to the real world. This causes a passive participation of biology teachers, because they fail to see the relevance of the laboratory practice and the significance of biology in broad-spectrum (Osborne, Simon, & Collins, 2003). The major barriers to Biology Science education in senior high schools to support learner-centered technique include Biology teachers' bad attitude, lack of laboratory practices, lack of time, lack of technology, low level of Biology teachers' knowledge of learner-centered instruction, and lack of standardized Biology tests. Learner-Centered Teaching Techniques (LCTT) offers an alternative approach which could help make Biology concepts more practically accessible for students. Learner-Centered Teaching Techniques based Biology Science education, according to Gilbert, Bulte and Pilot (2011), is intended to shift from a teacher or lecturer focused classroom environment to one that is focused on the needs of the students. Learner-Centered Teaching Techniques (LCTT) is an active search for meaning by the learner and constructed rather than passively received. With LCTT, in a learner-centered teaching environment, learners actively participate in their own learning, make decisions about what and how they will learn and become capable of constructing new knowledge and skills by building on past experiences (Mike, n.d.). Biology teachers with the right attitude and requisite knowledge have a vast responsibility to introduce students to laboratory practices and to motivate them to learn the subject. Ideally, senior high school biology teachers create the academic and emotional/mental basis environment for their students' laboratory practices comprehension and encourage them not only to continue the study of those subjects but to become life-long learners in those areas. Ritchie and Rigano (1996) indicated that instructional practices of Biology teachers should assist learners to acquire

process skills. Yeboah (2010) posits that a sound theoretical and practical knowledge of Biology is needed for the management of our natural resources, provision of good health facilities, adequate food supply and favourable environment. To improve the quality and quantity of laboratory practices, Biology teachers need to be motivated to apply learner centered techniques in teaching and learning of Biology. In addition, Biology teachers are required to be competent in using laboratory equipment and should have the requisite laboratory management skills (Copriady J. P., 2015). Bryan (2003) opines that biology teachers who are competent in ensuring students conduct experiments without mistakes make practical effective. This was the motive why the researcher took it as a challenge to research into this matter of examining of Biology teachers' knowledge, attitude and use of laboratory practices of learner-centered teaching techniques in teaching and learning.

1.2 Statement of the problem

In Ghana, the teaching of Biology in Senior High Schools is to guide and inculcate in the learner practical skills, which includes observation, measurement, formulation of hypothesis, predication, designing, investigation, recording and interpretation of data, drawing conclusions and communicating them (Curriculum Research and Development Division, 2010). It is also stressed that Biology lessons should be learner-centered and activity-based, with the teacher serving as a facilitator or guide. To meet the defined objectives of the Senior High School Biology syllabus in Ghana, highly knowledgeable professional teachers with a high level of positive attitude in practical work are required. However, efforts towards the implementation of learner-centred teaching strategies are defeated by teachers still using teacher-centred teaching strategies (Curriculum Research and Development Division, 2010). Also, strategies which increase learner-engagement, as well as those which increase

learning during lesson delivery have been inadequate (Ornelles, Ray, & Wells, 2019). Despite the fact that Ghana is billed as the first independent country in Sub-Saharan Africa to launch a comprehensive campaign to promote science education and the application of science to industrial and social development (Annan & Yawson, 2019), her Senior High School Biology students are still having difficulty answering practical Biology questions. From Jirapa municipal education office, performance of students in biology indicates a consistent poor performance in WASSCE from 2018-2020 as illustrated in Table 1.

Table 1: Percentages of WASSCE Results, Jirapa Municipal, Upper West

Year	Grade: Obtained (A1-B3)	Grade: Obtained (C4-C6)	Grade: Obtained (D7-F9)
2018	3.70%	45.13%	51.17%
2019	2.23%	43.86%	53.91%
2020	0.86%	33.24%	65.90%

Source: Municipal Education Office, Jirapa

More than half the candidates in 2019 and 2020 could not have had access to tertiary biology education with such performances. Results of this nature can largely be attributed to poor teaching techniques in biology, poor preparation of teachers to teach biology (Butakor, Ampadu, & Cole, 2017) and due to the traditional approaches to teaching (Anamuah-Mensah, Mereku, & Ghartey-Ampiah, 2008). Biology teachers' low practical and theoretical knowledge both in content and pedagogy can hinder their actual teaching performance (Bello, 2015). This could be due to the fact that teachers have poor attitude towards the learner-centred teaching strategies or have little or no knowledge about the learner-centred, laboratory-based strategies. These shortfalls may exist in Jirapa Municipal Senior High Schools' biology classrooms, hence the

need for this study. On this note, this study is structured to examine the biology teachers' knowledge, attitude and use of laboratory practices of learner-centered teaching in the Jirapa municipality.

1.3 Purpose of the study

The intent of this study is to examine Biology Teachers' Knowledge, Attitude and use of laboratory practices of learner-centered teaching techniques in Jirapa Municipality.

1.4 Objectives of the Study

The researcher anticipates to achieve the outlined specific objectives.

1. Determine biology teachers' knowledge of laboratory practices in teaching and learning of biology.
2. Ascertain biology teachers' attitude towards the use of laboratory activities in teaching biology.
3. Investigate how biology teachers in some selected SHS in Jirapa municipality use laboratory practices in the teaching and learning of biology.
4. Find out the hindrances in the teaching and learning of biology

1.5 Research question

The study was guided by the following research questions:

1. What is biology teachers' knowledge in the use of laboratory practices in teaching and learning biology?
2. What is the biology teacher's attitude towards the use of laboratory practices in teaching and learning of biology?
3. To what extent do biology teachers in the selected SHS use laboratory practices in teaching?

4. What are the hindrances that biology teachers face in the teaching and learning of biology?

1.6 Significance of the Study

The significance the researcher will ascribe to this research are listed as follows:

Firstly, the information obtained from the study uncovered the Science Teachers' knowledge level, attitude and laboratory practices that hinder the use of learner-centered teaching techniques. This may go a long way to guide teachers in SHS and grant them the opportunity to engage, encourage and involve their students in learner-centered oriented lessons.

Secondly, the study may also provide very useful information to the Ministry of Education (MOE), government and other authorities and agencies to provide interventions so as to promote learner-centered teaching techniques in Biology Education in teaching and learning.

Finally, this study will serve as literature for review in further studies by other researchers who are interested in advancing knowledge on the central theme of the study.

1.7 Delimitation of the Study

This research was conducted in the Upper West Region of Ghana precisely in the Jirapa Municipality. Only four SHS, namely, St. Francis Girl's Senor High, Jirapa Senior High, Hain Senior High and Ullo Senior High School were used for study. The study also addressed only biology Teachers' Knowledge, Attitude and use of laboratory practices of learner-centered teaching techniques in teaching biology.

1.8 Limitation of the Study

The result of the study is only applicable to the selected schools and cannot be extended to other schools in the region since other schools were not covered by the study.

1.9 Organisation of the Study

The research encompasses five chapters and is summarily listed below:

The First Chapter is an introduction which consists of the background of the study, statement of the problem, the purpose of the study, objectives of the study, research questions, the significance of the study, the limitation of the study, delimitation of the study, and the organisation of the study. The Second Chapter involves the literature review which deals with other personalities' views about the problem under study.

The Third Chapter focuses on a methodology that talked about the method employed in doing the study. It deals with the research design, population and sampling techniques used in the study. It also consists of the data gathering instrument, validity and reliability, data collection procedure and data analysis as well as ethical considerations.

The Fourth Chapter deals with the presentation of the results or findings of the study.

Finally, the Last Chapter summarises, concludes and gives recommendations for the study.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter discusses the relevant literature on the area of study. Areas that were looked at include science practical work, teaching and learning of science, methods or strategies employed by teachers in teaching the science subjects and teaching and learning environment. The review also looked at the challenges facing science in terms of equipment and human resources. It finally discusses the impact of science practical on the study of science.

2.1 Science practical work

Practical work, which is 'hands-in' is an essential component when it comes to the study of the natural sciences, such as biology, chemistry and physics. It is based on the assumption that learning by doing is the best for acquiring scientific skills. The 'hands-on' approach has the potential to stimulate student's interest in the subject matter, teach laboratory skills, enhance the acquisition of knowledge and give insight into the scientific attitudes and skill development. According to Freedman (1997), the motivation to learn science does not only depend on interest that the students bring to school. It can also be the result of certain learning situations, among which we find laboratory.

Research on science teaching provides at least two reasons that support the inclusion of real- life issues in science teaching. First, real- life applications of science have been found to play a role in helping students reconcile their experience-based prior knowledge about the world with scientific explanations. Studies of science learning as a process of conceptual change, as well as studies of knowledge transfer suggests that

students need to use ideas and concepts in multiple real-world contexts in order to understand their meaning (Wandersee, Mintzes, & Novak, 1994).

According to McComas (1996), real-life applications may be a way to engage student's interest in learning science. From a learning theory perspective, it is hypothesized that students become more engaged in their learning when they see the practical importance of the knowledge, they are studying (Pintrich & Schunk, 1996). Many studies provide evidence supporting the idea that student's interest is enhanced by their involvement in real-world science project and investigation (Moje, et al., 2004). Carrying out hands-on practical activities can also be engaging to students (Freedman, 1997). Although studies suggest that many students lose interest in science class after age 11 because they find school science boring (Osborne, Simon, & Collins, 2003), the aspects of science that students consistently report as most appealing is hands-on laboratory work (Myers & Fouts, 1992).

2.1.1 Teaching and learning of science

The science curriculum has an in-built flexibility to cater for the interest, abilities and needs of students. This flexibility also provides a means to bring a balance between the quantity and quality learning. Teachers should provide ample opportunities for students to engage in a variety of learning experiences as investigation, discussions, demonstrations, practical work, project, field studies, model-making, case-studies, oral report, assignment, debates, information search and role play. Practical work and investigations are essential component of the science curriculum. They enable students to gain personal experience of scientific knowledge through hands-on activities and to enhance the skills and thinking processes associated with the practice of science. Participation in these activities encourages student to bring scientific

thinking to the processes of problem solving, decision making and evaluation of evidence.

Engaging in scientific investigation enables students to gain an understanding of the nature of science and the limitations of scientific inquiry. Presently, practical activities at all levels of education are to be provided through the use of either the conventional approach or computer assisted approach. The conventional approach includes the use of standard laboratories, science kits, teacher demonstrations and other activities. Thus, there are procedures organizing practical work in schools' which tutors are expected to be following. But paying heed to such procedures remained an interesting phenomenon to investigate. The current approach to science teaching in most senior high school is most often based on classroom and laboratory work which are intended to meet examination requirements.

Unfortunately, the examination-driven mode of science teaching has limited the scientific and technological scope and perspectives of the students. Not only does the approach tend to make the study of science uninteresting and boring, but also students find it difficult to relate the theoretical knowledge with the practical realities of life and the use of manipulative skills. There is also very little orientation for problem solving, inculcating of investigative skills and counseling on science career opportunities.

The process skills reveal some of the processes of science. These include observing and describing, classifying and organizing, measuring and charting, communicating and understanding communication with peers, predicting and inferring hypothesizing, hypotheses testing, identifying and controlling variables, interpreting data and constructing instruments (Agbola, 1984). According to him all these processes can be

achieved through group work during practical activities. He is also of the view that some of the specific human abilities are important in the process skills domain and are visualizing (thus producing mental image), combining objects and ideas in new ways as well as offering explanations for objects and events encountered. Others are questioning, producing alternate or visual uses of objects, solving problems and puzzles, designing devices and machines, producing usual ideas and devising tests for explanations created. Development of the above domain will not be achieved if the practical work is not effectively used during science lessons.

Attitudinal domains such as values, human feelings and decision-making skills are also important enough to be addressed at the senior high school level. Practical work done in group enables students to develop positive attitudes toward themselves, positive attitude towards the science subjects in general and science teachers. It also affords the student the opportunity to develop sensitivity and respect for others, expresses personal feeling in a constructive manner and to make a decision about personal values, social and environmental issues.

In application and connections domain, (Adedapo, 1976) observed that science is related to everything, especially subject such as mathematics, social science, vocational subjects and the humanities. Practical work done by students during science lessons enable them to develop scientific concepts and skills to everyday social problems. Not only that, practical work enables students to understand scientific and technological principles involved in household technological devices and to evaluate the mass media report of scientific development.

2.1.2 Method used in teaching the sciences

There are many methods of teaching employed in the teaching of science at the senior high school level. No simple method can be said to be sufficient in the teaching and learning of science at the senior high school level. There is, therefore, the need to search for more effective strategies that are likely to improve achievement in senior high school science.

Such strategies include co-operative learning or instructional strategies (activity based) which have been found to improve science learning outcomes (Okebukola, 1984). The benefit of co-operative learning for science students are well documented (Lord, 2001). Cooperative learning improves student achievement and enhances student enjoyment and attitudes towards learning science (Springer, Stanne, & Donovan, 1999). Cooperative learning works, because it is active, student centered and social (Johnson & Johnson, 1989). A cooperative learning activity might involve reading, writing, planning experiments, designing questions, or solving problems. This multi-layered approach toward student interaction with the content improves understanding and retention. Since, cooperative learning shifts emphasis from the instructor to the students, the latter have opportunities to build social support networks and to learn and practice many social skills, such as leadership, communication, inquiry and respect for diversity (Lord, 2001).

The development of social relationships and skills help students to build confidence as learners and to build trust in their teammates. This leads to improve attitudes toward the subject and often to the retention of underrepresented populations in science programmes. Peer tutoring is a type of cooperative learning/instructional strategy. It is a personalized system of instruction which is learner rather than teacher-oriented. Studies have shown that this instructional strategy benefits both the students being

tutored and the teacher, although the teacher is associated with greater cognitive gains than the student being taught (Bargh & Schul, 1980). It has also been observed that when science lessons are done in groups, students are allowed to make valuable decisions which together lead to a satisfactory accomplishment. Mary (1996) explained that group work during practical is a pervasive and an influential feature of the classroom ecosystem, which can be encouraged in the teaching and learning of science in school.

2.1.3 The activity-based methods of teaching

The procedure used for the activity-based methods of teaching is based on current information and research psychology involving cognitive, affective, experiment and maturational issues. Some of the methods used for teaching science lessons include group activity, project work, practical work, inquiry, discovery, discussion and demonstration. In all these methods, practical work is found to permeate all aspect and they in turn relate to one another. According to Lazarowitz, Lazarowitz-Heads and Bird (1994) teaching methods generally involve heterogeneous groups working together on tasks that are deliberately structured to provide specific assignments and individual contributions for each group member.

Von Secker & Lissitz (1999) found that 'Teacher- centered instruction is negatively associated with achievement. On the other hand, mean science achievement is expected to increase with the amount of emphasis on laboratory inquiry''. The authors concluded that de-emphasizing traditional, teacher-centered instruction is expected to increase average science achievement and minimize gaps in achievement between individuals of different socio-economic status

2.1.4 The teaching and learning environment

There are many aspects to determine the success of learning process. One of the aspects is learning environments. A research study conducted by Fraser (1994) showed that learning environments do not only have the positive correlation with the students' outcomes, motivations, and attitudes, but also teachers' motivation perception, and evaluation of the strategies. According to him, the factor that contributes most to self-evaluation is the learning environment. Such an environment allows students to synthesize, analyze, explore, criticize and create their own concept about the learning material. A study conducted by Onyegegbu (2001) revealed that secondary schools science students in Nigeria, approach laboratory activities with mixed emotions. For some, these activities are windows on the world of science, allowing them to gain experience with the techniques, concepts and emotions that go with real research. For some others, practical lessons in science laboratory are exercise in preordination, tedious derivation of answers that are already known to questions that do not seem important.

According to him, one of the major problems that he experienced as a science teacher in the secondary school laboratory, is that, teachers feel that demonstrating or carrying out activities in the laboratory amounts to inviting trouble, and is tedious. Often this turns out to be major cause of their indifference to practical work. Moreover, science topics are so restricted to examination scheduled curriculum that teachers must comply with if their students are to pass their external examination.

A survey of secondary school science laboratories in Nigeria reveals that many of them are underfunded with outdated equipment (Onyegegbu, 2001). The classroom experience shows that a large number of the secondary school science students face considerable difficulty in appreciating and learning scientific concepts in a

meaningful way, especially in laboratory activities. This is a clear reflection of their poor ability to solve simple day to day problems, make predictions in given situations and poor ability to apply scientific concepts to explain ordinary natural phenomena. However, on the part of science teachers, it is rather disturbing to note the apathy or indifference, with which science practical activities are conducted in the laboratory. Practical activities if done in the laboratories are done with the mundane, unimaginative manner (Onyegegbu, 2001). These finding in the researcher's opinion are not different from what pertains in the senior high schools in Ghana. The classroom laboratory and the school environment can be made conducive to teaching and learning of science through improvisation of materials by teachers when standard laboratory equipment are not available.

2.1.5 Time Allocated for Science Lessons

Time, is a resource which is not renewable, non-interchangeable and finite. Most science teachers overlook the practical aspect of the subjects perhaps because of time allocated for the teaching and learning of science and the number of topics to be covered. Pratt (1996) is of the view that the greatest amount of the time that is used in schools and that is spent by pupils, is the time that is committed not by their consent but by order of their elders.

Matthew (1989) is also of the opinion that a pupils' level of attainment was directly related to the period of time actively spent on learning. This finding was also supported by the International Assessment of Education Progress (IAEP) Projects in 1991/92. Mathew's opinion also holds for the science practical work. The science curriculum for senior high schools advocated for seven periods of forty minutes a period in a week. It also recommended that 4 periods and 3 continuous periods be respectively allotted to theory and practical work (Ministry of Education, 2003).

Though the idea of time allocation was clearly spelt out in the syllabus, most senior high schools could only have six (6) periods of forty minutes per week allotted for science. The one extra period is allotted to other subject areas depending on the school. This inadequacy of lesson time for science perhaps has forced teachers to ignore the practical work when teaching in order to be able to complete the syllabus.

Fisher and Fraser (1990) gave two ways by which time for subjects can be allotted in the curriculum. The two ways were time allotment in periods and allotment of time to the subjects, taking into consideration the number of activities involved in the teaching and learning of the subject. This to them will give adequate time for practical lesson. Fisher and Fraser (1990) reviewed a substantial body of research in which measures of time to learn a particular kind of subject matter and conventional measures of intelligence, have both been used to predict learning. The time to learn measures are usually good of better predictors that are intelligence measures.

Kraft (1994) in his view sees the amount of time spent on the basic of language and mathematics as a critical factor in the achievement level of students in science. Craft's student which was focused on primary education gives insight into time allocation and use in our school.

According to him, while the length of primary school year in Ghana was 800 hours per year, it was 1080 hours, 1290 hours and 1128 hours per year in Benin, Burkina Faso and Nigerian respectively. He is of the opinion that not only do Ghanaian children spend less time in school than many others, but the actual academic learning time is less by two to three hours a day. This means that the underutilization or mismanagement of instructional time could result in a limited coverage of the designed curricula, which will finally have negative effect on the student's performance.

Due to that, Hurd (2002) suggested increasing the amount of time allotted for active experimentation in science as a way of increasing participation by students who are poorly motivated. He cautioned that often teachers use teacher centered instructional techniques and design seat work unmotivated students while more motivated Student perform laboratory activities and are given assessment involving problem solving.

Instructional time refers to a family of concepts, some of which have not yet achieved the status of concept in other, more matured scientific fields (Berliner, 2009). Berliner (2009) gave different dimensions as follows:

1. Allocated time, usually defined as the time that the states, districts, schools, or teachers provide for the instructions for the student.
2. Engaged time, usually defined those students appear to be paying attention to material or presentation that have instructional goals.
3. Time-on-task, usually defined as engaged time for a particular learning task. The arrangement must be on particular learning tasks but not just general task.
4. Academic learning time, usually defined as that part of allocated time, in subject matter area (science, mathematics, etc.) in which a student is engaged successfully in the activities or with the material to which he or she is exposed, which are related to educational outcomes that are valued.
5. Transition time, usually defined as the non-instructional time before and after some instructional activity.
6. Perseverance, usually, defined as the amount of time a student is willing to spend on learning a task or unit of instructions.
7. Pace, usually defined as the amount of content covered during some time period.

Instructional time intended for science varies across countries participating in the trends in Mathematics and science study (TIMSS). Some countries spend up to 32% of instructional time on science (Martin, Mullis, & Chrostowski, 2004). Stigler, Lee and Stevenson (1987) found that Japanese and Chinese children spent much more time on learning than American children. In the United States the curriculum does not specify the percentage of total instructional time for science of 180 minute per week. This amount of instructional time is comparable to one in higher achieving countries such as Singapore.

As indicated by Sheppard and Robbins (2002) there has been very little discussion about the time allocation for science in US high schools. The committee of ten recommended that 25% of curricular time on science. This estimate is based on six periods a week out of 40 periods per week.

Time allocation in Ghana is somewhat smaller considering that other countries allow their students to enroll in more than one science course per year, thus leading to greater time allocation. Because of the experimental nature of science, more time should be devoted to it in the classroom. Curricular time in science in Ghana, like many other countries, has not matched the significant increase in science in the number of science topics to be taught at the senior high school level.

2.2 The concept of attitudes

The concept of attitudes is very complex and difficult to measure. Many definitions and explanations have been put forward in many areas of learning; including social psychology and social science. There seems to be an interrelationship between beliefs and attitudes. The attitudes toward science may be viewed as a more purposeful way of summarising a wide range of beliefs about science which in turn allows the

prediction of science related behavior. Scientific attitude implies certain ways of approaching problems. It also implies an attitude of wanting to find explanations that are secular and do not refer to authority (Schreiner & Sjoberg, 2004). Attitude toward science, however, may be viewed as a wide variety of beliefs about science.

The investigation of students' attitudes towards studying science has been a substance feature of the work of the science education research community for the past 30 years. Its current importance is emphasized by the now mounting evidence of a decline in the interest of young people pursuing scientific careers (Smithers & Robinson, 1988) . Combined with research indicating widespread scientific ignorance in the general populace (Bauer & Durant, 1997), and an increasing recognition of the importance and economic utility of scientific knowledge and its cultural significant, the falling numbers choosing to pursue the study of science has become a matter of considerable societal concern and debate (Lord, 2001).

Consequently, the promotion of favourable attitudes towards science, scientists and learning science, which has always been a component of science education, is increasingly a matter of concern. Several studies have been carried out with the focus on students' attitudes toward a particular discipline, such as physics or Chemistry and a few focusing on students toward science (Spall, Stanisstreet, Dickson, & Boyes, 2004)

2.3 Challenges facing science practical work in terms of equipment

2.3.1 Equipment for science education

The term equipment; as used in this report, covers all the supporting materials for science teaching excluding text books, other printed materials and the usual classroom

materials and facilities such as blackboards and furniture. It may also include perishable items (e.g., glassware) and consumables (e.g., chemicals).

Practical activities at different levels of sophistication are present in the majority of schools science curricula at the primary level and particularly at the lower and upper secondary levels. Practical activities usually require special facilities and equipment are by many considered essential, it is not necessarily so.

In many countries, science education is suffering from a lack of appropriate facilities and supporting materials, including equipment. Modern curricula and textbooks based on discovery learning are sometimes used, but in the absence of practical activities it is questionable if the student receive a better understanding of science than they did when books and curricula were based on lecturing and blackboard teacher demonstration (Håkansson, 1983).

To improve the situation, many national, regional and international project have been launched, emphasing laboratories and equipment. However, their success was in many cases far below the expected. The World Bank has supported secondary school science in over 100 projects; generally, the equipment components were a substantial part of the total expenditures. In bank evaluations, almost half of the outcomes were assessed to be negative. Other bank projects, which were successful from the equipment acquisition and distribution point of view, were found not to improve the equality of science education substantially. In some cases, the equipment provided was not used at all, and it was possible to find twenty years old equipment kits in their original packages (Schmit, 1983).

2.3.2 Materials for Science Practical Work

Availability of teaching and learning materials for science practical work plays an important role in the learning of science. Many scholars (Bajah, 1986) contended that availability of physical and material resource is very significant for the success of any worthwhile educational endeavour. These researchers agreed that, availability of adequate school buildings, number of classrooms, chairs, desks and laboratories for science teaching are imperative for the attainment of any educational objectives.

In his study, Bajah (1986) found a significant relationship between teachers, facilities and schools' academic performance. In his view, Bajah noted that teachers are more important than the equipment of laboratory for the understanding of the science concepts. Laboratory equipment may remain teaching materials for the improved performance without teachers. Despite conventional wisdom that school inputs make little difference in student learning, a growing body of research suggest that school can make a difference and a substantial portion of that difference is attributed to teachers.

Though practical lessons are to be used by teachers to help their students to achieve better results in science, it was sad to find in most of the Senior High Schools (SHSs), the science laboratories were ill-equipped with materials and equipment necessary for practical lessons (Serwaa, 2007).

Adequate provision of instructional materials is an important method that science teachers can use to promote skill acquisition by students (Eshiet, 1987). Ogunyemi (1990) found out that when physical and material resources are provided to meet the needs of the school's system, students will also learn at their own pace. The net effect is that it increases the overall academic performance of the students. In his own

contribution, Gamoran (1992) noted that school resources and books in the library alone, had little on the students' achievements once background variables must be catered for in addition to supplying them with the required educational materials at the secondary level to propel the students to higher achievement.

2.3.3 Distribution

In some cases, purchased equipment are not supplied to schools, but are stored in a central warehouse for a very long time (Gaillard & Ouattar, 1988). Reasons may be different, ranging from bureaucratic procedures to physical inability to distribute the equipment across the country.

Another kind of problem is connected with the relative inflexibility of supply and distribution schemes. It often happens that some standard sets of new equipment are distributed to all schools even when the existing supplies vary considerably. It might also happen that certain items are not included in the pack, because the majority of schools already have them. The result is that a number of schools will never get that particular piece of equipment, while other schools will get equipment they already have.

2.3.4 Supply of consumables

Consumable materials (for example chemicals) aspect is a significant part of the total costs of science education in developing countries. They are necessary for utilization of the equipment. However, the funds for consumables are not always available. This is particularly true if they have to be imported (i.e., must be paid in foreign currency). Distribution problems occur here, similar to the problems encountered at the distribution of equipment. Many countries are still using hazardous chemicals which

are now no longer used in most developed countries at this level (Ware Jr & Sherbourne, 1992).

2.3.5 Maintenance, repair and replenishment

Teachers and laboratory technicians (where available) are rarely trained properly in the maintenance of the equipment, either in pre-service or in-service training programs (Lowe, 1983). If the equipment is in use, it will eventually break down teachers should be able to carry out simple repair, but the repair is organized in some countries and generally they are not available. A missing or broken inexpensive part may render a whole equipment kit unsuitable unless it is replaced. Single items for replenishment are not always in stock and available for school to acquire.

2.4 Challenges facing science practical work in terms of human resources

2.4.1 Practical work and the student's learning of science

Good use of practical can help students become positively motivated towards science. Conversely sub-standard implementation can have the adverse effect. Recent studies have observed sciences' poor use of this tool and the negative effect it has had on students' opinion of science (Curriculum Research and Development Division, 2010).Where science teachers focus more lesson time on assessment, less time is available for practical work. A diminished use of practical is shown, not only, to be detrimental to student's understanding of scientific concepts, but also, to quash their interest towards science (Osborne, Simon, & Collins, 2003).

2.4.2 Who is teaching our Students?

General dischantment towards teaching has depleted supplies of physical science expertise within UK science departments (Menter, Hutchings, & Ross, 2002). Furthermore, difficulties have prevailed with the recruitment and retention of teachers specializing in these subjects. For schools to ensure the delivery of these sections of

the science curriculum, new directives have been introduced, whereby qualified science teachers, irrelevant of subject, are expected to adopt any of the science disciplines to teach to students (Menter, Hutchings, & Ross, 2002). Where students have perceived, and consequently selected, pre-university biology graduates, and hence postgraduate-trained biology teachers have become more prevalent (Menter, Hutchings, & Ross, 2002). As a result, there are more biology trained teachers than physical science teachers, especially physicists, within science departments (Smithers & Robinson, 1988). Schools, lacking in any specialism supply, have been compelled to fill these gaps with non-specialist staff (Kind & Taber, 2005). These sequences of events have culminated to significantly decrease the numbers of students exposed to teachers with physical science knowledge.

2.4.3 Why students need specialist teachers to supply their learning

Studies portray non-specialist teachers produce more rote learning. 'Recipe style' practical work and less creativity in students' science lessons. This is attributed to science teachers being in sufficiently confident with technical ability to safely deliver practical work during lessons (Abrahams, Millar, Whitehouse, Reiss, & Amos, 2011). Furthermore, non-specialist teachers, allocated with physical sciences, display a greater reluctance to use practical work. Effective practical work becomes more unlikely in science departments, where teachers lack crucial updates in technical skills and the available skills are dissipating. How teachers portray their subject matter can drastically influence students' career choices and options at non-compulsory qualifications (Soares & Lock, 2007).

2.4.4 Problems with non-specialist science teaching

Studies portray non-specialist teachers produce more rote learning 'recipe style' practical work and less creativity in students' science lessons. Blame has been

attributed to science teachers being insufficiently confident with the technical ability to safely deliver practical work during science lessons (Abrahams, Millar, Whitehouse, Reiss, & Amos, 2011). Furthermore, non-specialist teachers charged with physical science subjects display a greater reluctance to use practical work. Practical work needs to be appropriately implemented, within science lessons, to provide relevance for students and improved access to understand abstract, scientific concepts (Lord, 2001). However, literature shown that schools with insufficient supplies of specialist science teachers affects students' choice and performance at pre-university level (Lord, 2001) and lowers their chance of attainment. Although quality teaching and passion, towards subject matter, are important, for student motivation and interest this wane where student attain no inherent value, for inspiration (Cerini, Murray, & Reiss, 2003).

2.5 Impact of science practical work on the study of science

In Shulman and Tamir (1973) review of research on science teaching, they identified three rationales generally advanced by those that supported the use of laboratory in science teaching. The rationales include:

1. The subject matter of science is highly complex and abstract,
2. Students need to participate in enquiry to appreciate the spirit and methods of science
3. Practical work is intrinsically interesting to students.

Shulman and Tamir also compiled a list of objectives of using laboratory work in science teaching. The list included the teaching and learning of skills, concepts, attitudes, cognitive abilities, and understanding the nature of science. Also, there is

hardly any science method's book that does not usually list the objectives of science laboratory work (Abrahams & Saglem, 2010).

All science curricula in Ghana list practical activities that should go with each curriculum item listed. The West African Examinations Council (WAEC) syllabus recommended that the teaching of all science subjects listed in the syllabus should be practical based, perhaps, to demonstrate the importance it attached to practical work in science (WAEC, 2015). Thus, several decades of emphasizing the assumed importance of laboratory work in science teaching have elevated the importance to the level of a dogma. White and Tisher (1986) are of this opinion. This position is, perhaps, why Yager "'meal'-the main course'' rather than an; "extra'' or "the desert after a meal''. "All science teachers and students know that practical work is the 'gem' of science teaching''. This dogma about the importance of laboratory work originated from the views of a few American educationists in the early sixties that extolled the importance of laboratory work in science teaching. Notable among these personalities are Bruner (1986) and Gagne (1963), they all extolled the virtues of teaching science as a process of inquiry or discovery.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This chapter describes techniques, tools and processes used to collect and analyze data for the study. Specifically, the chapter consists of the research design, population and sample and sampling technique, research instrument, reliability and validity, Data collection procedure, Data analysis and ethical considerations.

3.1 Area of study

Jirapa is the capital town of Jirapa Municipal in Upper West Region. It shares boundaries with four Districts. To the north of Jirapa is Lawra District. To the North-East it shares boundary with Lambusie /Karni District and Bussie /Issah/ Daffiamah District to the East. It is bordered by Nadowli District to the south. Figure 1 shows the map of Jirapa below.

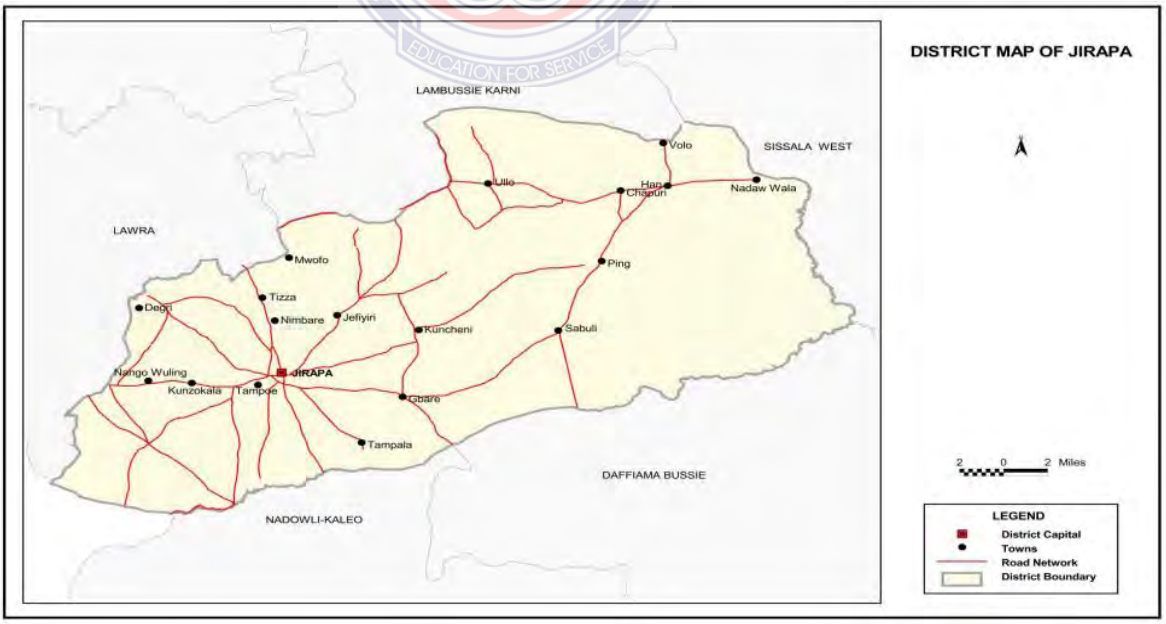

Figure 1: Map of Jirapa Municipal
Source: Jirapa Municipal Assembly, 2013

The geographical Coordinates of Jirapa are as follows: 10°32′N 2°42′W / 10.533°N 2.700°W. The Municipal has a total population of 88,402 comprising 46810 females and 41592 males (Ghana Statistical Service, 2021). It has total land area of 1,667sq km. This represents about 9% of the total area of 18,476 sq. km in the region. The population of Jirapa municipality displays a typical character of a young municipality, a heavy concentration of the population in Jirapa town surrounded by smaller towns and rural settlement. The inhabitants in the municipality are mainly Dagaaba and they speak Dagaare as their native language and are predominantly peasant farmers. Few inhabitants who are government/public servants working in government intuitions came to the municipality as a result of labour mobility. The municipality has only four senior high schools namely St Francis Girls' senior high, Jirapa senior high, Ullo senior high and Hain senior high. The study covered all the senior high schools in the municipality.

3.2 Research Design

Hassan (1995) views research design as a blue print of activities or specification of procedures and strategies to follow so as to obtain the most value answers to research question or attain the objectives of study with optimal control of variables. The approach used in this study is quantitative in nature. The descriptive survey design was taken for the study. The descriptive survey research design entails a critical observation of events, objects, subjects and ideas without attempt to control the condition of such phenomenal. It is a description of a given state of affairs that exist at a particular time which required a direct contact with individual whose characteristic, behaviours and attitudes are relevant to the investigation (Jongbo, 2014). This research design was used because it provided information useful to the solution of the problems. It employs application of scientific method by critically analysing and

examining the source materials, by analysing and interpreting data, and arriving at generalisation and prediction (Salaria, 2012). The advantage of descriptive research is that of allowing for the research to be conducted in the natural environment of the respondent and this ensures that high-quality and honest data is collected. And the disadvantage is that of respondents aren't always truthful if questions are too personal or they feel that they are being "watched". This may negate the validity of the data (Salaria, 2012).

3.3 Population

A population is entirely the unit or individuals of interest (Hanlon & Larget, 2011). The target population for the research was 37 biology teachers. The accessible population is the same as the target population and therefore covers all the biology teachers in the senior high schools namely St. Francis Girls' SHS, Jirapa SHS, Ullo SHS and Hain SHS in the Jirapa municipality in the Upper West Region.

3.4 Sample and Sampling Techniques.

Sample is defined as a subset of the population considered for a study (Agyedu, Donkor, & Obeng, 2007). Information obtained from a good sample is representative of the total population under the study (Creswell & Plano, 2007). However, the only four Senior High Schools in Jirapa municipality were made up of 30 males and 7 females totaling 37 biology teachers. This study used all the biology teachers from the four senior high schools in the Jirapa municipal. All the biology teachers were thirty-seven (37) and were purposely selected for the study. Purposive sampling technique is a non-probability sampling technique that is used to select participants based on the characteristics of the population and the objective of the study (Creswell & Plano, 2007).

3.5 Data Collection Instrument

The instruments used to collect data for the study were questionnaires and observations schedule, respectively.

3.5.1 Questionnaire

A questionnaire is defined as a document containing questions and other types of items designed to solicit information appropriate to analysis (Babbie, 1990). It was chosen because of the nature of this study to get the opinions and views of the respondents. Respondents reply to them on their own free will without any influence from another person; they are easy to be administered within a short time and from the relatively larger groups of people who may be scattered geographically. The questionnaires for the biology teachers were sectioned into five segments; the first segment dwelt on the social-demographic characteristics of respondents which included sex, age, years of teaching experience, academic qualification and professional qualification. Section B contained 10 items and elicited information on teachers' knowledge of laboratory practices in teaching and learning of biology. Section C contained 10 items and elicited information on biology teacher's attitude in teaching and learning of biology. Section D contained 13 items and elicited information on the extent biology teachers in the selected SHS use laboratory practices in teaching. Section E contained 6 items and elicited information on the perceived hindrances in the teaching and learning of biology. In sections B to E, all of the items were closed-ended and on a three-point Likert scale. On a five-point Likert scale, respondents were asked to rate the intensity of their responses to each of the items. Agree (3), neutral (2) and disagree (1) were the scores for comments. Attached is the questionnaire at the Appendix A.

3.5.2 Observation

Observation is defined as "the systematic description of events, behaviours, and artefacts in the social setting chosen for study" (Marshall & Rossman, 2015). Observations enable the researcher to describe existing situations using the five senses, providing a "written photograph" of the situation under study (Erlandson, Harris, Skipper, & Allen, 2014). Observation can be categorised into Structured or Unstructured observation. Observation provides several advantages over other methods of data collection. These include “it allows for richly detailed description, which they interpret to mean that one's goal of describing "behaviours, intentions, situations, and events as understood by one's informants" is highlighted; and it provides opportunities for viewing or participating in unscheduled events” (deMunck & Sobo, 2010) . And observation also “improves the quality of data collection and interpretation and facilitates the development of new research questions or hypotheses (DeWalt & DeWalt, 2002).

The lesson observation protocol consisted of thirteen items, which collected information on how practical activities were set up for students, the equipment and materials used, procedures used and how the practical activities were supervised. The observation protocol was used to determine whether the respondents’ expressed views in the questionnaire were consistent with their practices and to examine what goes on in the laboratory during practical work. Attached is the observation schedule at the Appendix A.

3.6 Validity and Reliability of Instrument

Content validity is the measure of the degree to which data collected using a particular instrument represents a specific domain of indicators of a particular concept. Reliability refers to a measure of the degree to which research instruments yield

consistent results (Mugenda & Mugenda, 2003). The instruments were reviewed by experts in science education at University of Education, Winneba to ensure their face and content validity, after which they were pre-tested in Nandom Senior High school and Wa Senior High school in the upper west Region of Ghana to estimate their reliabilities.

The items of the questionnaire were subjected to item analysis in order to identify those whose removal or modification would enhance the internal consistency of the instruments (Onwoioduokit, 2000). The Statistical Package for Social Sciences (SPSS) was used to determine the Cronbach alpha coefficient value for the questionnaire, which was found to be 0.79. According to Leech, Barrett and Morgan (2005), Cronbach alpha coefficient value of 0.70 and above indicates a reasonable internal consistency and that alpha value between 0.60 and 0.69 indicate minimal adequate reliability. According to Ary, Jacobs and Razavieh (2002), where results are used to make decisions about a group, reliability coefficient of 0.50 to 0.60 is acceptable. The questionnaire items were therefore reliable as the Cronbach alpha coefficient value was above 0.70.

To determine the reliability of the observation protocol, experts observed practical lessons in Nandom Senior High school and Wa Senior High school in the Upper West Region of Ghana using the observation protocol. The Cohen's kappa coefficient value, depicting inter-rater reliability of the observation protocol was determined using Statistical Package for Social Sciences. A Cohen's kappa coefficient value of 0.77 was obtained. According to Mutton and Coleman (2018), observation data with an inter-rater reliability of 0.7 or 70% is considered reliable. This implies that the observation protocol was reliable.

3.8 Data Collection procedure

To obtain authorisation to conduct the study, official letters were sent to the heads of the selected Senior High Schools. The questionnaires were given to 37 Biology teachers with at least three years of experience in the selected four senior high schools in the municipality. The surveys were administered directly to the respondents by the researcher. The researcher described the study's goal as well as any parts of the questionnaire that the respondents found difficult. All of the participants were told that the information they provided would be kept private. The questionnaire was delivered to each respondent with enough time to complete it. The questionnaire was completed and collected in four days, resulting in a 100% return rate.

A sub-sample of two teachers, one from a school in St. Francis Girls' SHS and the other from Ullo SHS school were used for the second phase of the research. An 80 minutes practical lesson each was observed using the observation protocol or checklist. The purpose of selecting two teachers was that the analysis of the quantitative data revealed similar responses by teachers and exhibit possible common behaviour during practical lesson. The observation was to cross check and identify discrepancies between respondents' knowledge and attitudes toward practical work based on the quantitative data gathered during the first phase. During the practical lesson, every observable behaviour (verbal and non-verbal) of the teachers were ticked (√). The researchers were non-participant observers. Notes were also taken during the lesson to take care of relevant issues not covered by the observation schedule, such as the topic and objectives for the lesson, list of materials and equipment used in each observed lesson. Notes were taken on the nature of laboratory activities and the involvement of students in these activities.

3.9 Data Analysis

According to Kothari (2004), data analysis is a process of editing, coding, classification and tabulation of collected data. Creswell (2014), explain that data analysis is usually connected and integrated when interpreting data and doing discussion. The respondents' responses to the five Likert- scale type questionnaires items were analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Respondents highly agree and agree replies were interpreted as agree, strongly disagree and disagree responses were interpreted as disagree whereas neutral remained as neutral. The data was organised into frequency counts, percentages, and mean scores using the descriptive function of the SPSS. A mean score of 3 was regarded uncertain or neutral, whereas a mean score above and below 3 was considered knowledgeable and unknowledgeable respectively. Similarly, a mean score of less than 3 and more than 3 indicated negative and positive attitudes respectively, and a mean score of 3 was regarded as neutral. again, a mean score of less than 3 and more than 3 indicated high perceived hindrances and low perceived hindrances respectively, and a mean score of 3 was regarded as neutral. Pearson product moment correlation was used to determine the influence of Biology teacher's knowledge level in organising practical work on their attitudes toward laboratory practices.

3.10 Ethical Considerations

On the aspect of consent, before the researcher conducted the study in the schools, the researcher explained the main objective and specific objectives of the research to the Jirapa Municipal Education Authorities and sought permission to carry out the study in their municipal senior high schools. At each school, the informed consent of the heads of the schools and biology teachers were obtained before the data collection

begun. The researcher also informed the respondents of their right to withdraw when they felt like doing so. Before conducting the questionnaires, the researcher assured the participants that all data collected will be kept securely and treated as confidential. To maintain confidentiality, the schools and all the participants were given anonymous names in the data analysis and interpretation. Therefore, private data identifying the participants and their schools were not included in the report. As for the consequences of the study, the researcher assured all the schools and individual participants that she would take full responsibility for the consequences arising from the study.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

This part presents the analysis of the data gathered from Biology teachers from SHS in the Jirapa Municipality. This chapter also sectioned into three parts. The first section deals with the descriptive analysis of the socio-demographic background characteristics of Biology teachers and the second part presents results and discussion based on the selected objectives.

4.1 Socio-Demographic Background Characteristics of Respondents

In order to examine Biology Teachers' knowledge, attitude and use of laboratory practices of learner-centered teaching techniques in the Jirapa Municipality, demographic background characteristics were conducted. This includes the age, gender, academic qualification, professional status and number of years of practice of the respondents as indicated in Table 2 below.

Table 2: Demographics characteristics of the respondents

Demographic	Demographic	Frequency	Percentage
Gender	Male	28	75.7
	Female	9	24.3
	Total	37	100.0
Age	18-25 Years	6	16.2
	26-35 Years	17	45.9
	36-45 years	10	27.0
	Above 45	4	10.8
	Total	37	100.0
Academic qualification	Diploma	0	0.0
	First Degree	32	86.5
	Masters	5	13.5
	PhD	0	0.0
	Total	37	100.0
Professional Status	Professional	34	91.9
	Non-Professional	3	8.1
	Total	37	100.0
Number of years of practice	1-5 Years	11	29.7
	6-10	16	43.2
	11-15	3	8.1
	16 and above	7	18.9
	Total	37	100.0

Source: Field Work, 2021

The results as shown in Table 2 above indicates that majority 28 (75.7%) of the teachers were male and minority 9 (24.3%) of the teachers were females. This shows that there is gender inequality among biology teachers. Again, Table 2 illustrates that 6 (16.2%) of the respondents are within 18-25 years, 17 (45.9%) of the respondents are within 26-35 years, 10 (27.0%) of the respondents are within 36-45 years and 4 (10.8%) of the respondents are above 45 years. It can be concluded that majority of the biology teachers used in the research were between the ages of 26years to 35years. Moreover, majority of the biology teachers were first degree holders 32 (86.5%), followed by master's degree of 5 (13.5%) and 0 (00.0%) were for diploma and PhD, in respect of their educational qualification distribution. This show that biology teachers in the municipality have high educational qualifications. Their professionality distribution show that 34 (91.9%) were within the professional biology teacher group and 3 (8.1%) were within the non-professional biology teacher group. This indicates that majority of the biology teachers were professional teachers and can be confidently relied on for positive academic input. The distribution of biology teachers' years of experience in professional practice shows that 16 (43.2%) who had 6-10 years of experience representing the majority, followed by 11 (29.7%) of them who had 1-5 years of experience, followed by 7 (18.9%) of them who had 16 and above years of experience in the work while 3 (8.1%) of them who had 11-15 years of experience. Their experience level show that they have quite reasonable experience in the job fields which will guide them to give out their fair information of the study matter.

With respect to the socio-demographic characteristics of respondents, one can suggest that Biology teachers in Jirapa municipality in the Upper West Region of Ghana were mostly males and between the ages of 26years to 35years. They were professional

teachers with wide-ranging years of teaching experience and had first and second degree in Biology.

4.2 Research Question one

The results of biology teachers' knowledge in the use of laboratory practices in teaching and learning biology is shown in Table 3.

Table 3: Biology teachers' knowledge in the use of laboratory practices

SN	Statement I have knowledge in	Disagree	Neutral	Agree	Mean	SD
1	Giving clear explanation before practical work	0(0.0%)	2(5.4%)	35(94.6%)	2.95	.23
2	Demonstrating experiment before students' carryout experiment	2(5.4%)	3(8.1%)	32(86.5%)	2.81	.52
3	Helping students to write report on experiments	5(13.5%)	8(21.6%)	24(64.9%)	2.51	.73
4	Collecting animal and plant for Biology practical work	0(0.0%)	3(8.1%)	34(91.9%)	2.92	.28
5	Helping students in making Biology models	3(8.1%)	11(29.7%)	23(62.2%)	2.54	.65
6	Arranging field strips for finding answers to students' questions	8(21.6%)	15(40.5%)	14(37.8%)	2.16	.76
7	Using interactive white board for labeling diagrams	5(13.5%)	7(18.9%)	25(67.6%)	2.54	.73
8	Linking concrete and abstract experience of students	2(5.4%)	2(5.4%)	33(89.2%)	2.84	.50
9	Defining problem (topic) in simple language for students	1(2.7%)	1(2.7%)	35(94.6%)	2.95	.23
10	Handling equipment	1(2.7%)	3(8.1%)	33(89.2%)	2.87	.42
	AVERAGE				2.91	0.32

Source: Field Work, 2021

The results as indicated in table 3 show that of biology teachers' knowledge in the use of laboratory practices teaching and learning biology. On the first statement I have knowledge in: Giving clear explanation before practical work, 0 (0.0%) of the respondents were disagreed with the statement, 2 (5.4%) biology teachers were uncertain with the issue at hand while 35 (94.6%) of the respondents agreed to the statement that I have knowledge in giving clear explanation before practical work. On the second statement I have knowledge in: Demonstrating experiment before students' carryout experiment, 2 (5.4%) of the respondents were disagreed with the statement, 3 (8.1%) of the teachers were neutral with the matter while 32 (86.5%) of the respondents were agreed to the question that I have knowledge in demonstrating experiment before student's carryout their experiment. On the third statement I have knowledge in: Helping students to write report on experiments, 5 (13.5%) of the respondents were disagreed with the statement, 8 (21.6%) respondents were undecided with the issue while 24 (64.9%) of the respondents were agreed to the issue that I have knowledge in helping students to write report on experiments. On the fourth statement I have knowledge in: Collecting animal and plant for Biology practical work, 0 (0.0%) of the respondents were disagreed with the statement, 3 (8.1%) respondents were uncertain with the issue at hand while 34 (91.9%) of the respondents were agreed to the statement that I have knowledge in collecting specimen for Biology practical work. On the fifth statement I have knowledge in: Helping students in making Biology models, 3 (8.1%) of the respondents were disagreed with the statement that I have knowledge in helping students make models for Biology, 11 (29.7%) biology teachers were neutral with the issue at hand while 23 (62.2%) of the respondents were agreed to the issue. On the sixth statement I have knowledge in: Arranging field strips for finding answers to students' questions, 8

(21.6%) of the respondents were disagreed with the statement, 15 (40.5%) of the respondents were uncertain with the statement while 14 (37.8%) of the respondents were agreed to the issue. On the seventh statement I have knowledge in: Using interactive white board for labeling diagrams, 5 (13.5%) of the respondents were disagreed with the statement, 7 (18.9%) teachers were neutral with the issue at hand while 25 (67.6%) of the respondents were agreed to the issue. On the eighth statement I have knowledge in: Linking concrete and abstract experience of students, 2 (5.4%) of the respondents were disagreed with the statement, 2 (5.4%) of the teachers were neutral with the matter while 33 (89.2%) of the respondents were agreed to the question. On the ninth statement I have knowledge in: Defining problem (topic) in simple language, 1 (2.7%) of the respondent disagreed with the statement, 1 (2.7%) respondent is undecided with the issue while 35 (94.6%) of the respondents were agreed to the issue. On the tenth statement I have knowledge in: Handling equipment, 1 (2.7%) of the respondents were disagreed with the statement, 3 (8.1%) respondents were uncertain with the issue at hand while 33 (89.2%) of the respondents were agreed to the statement. The mean scores in the Table 3 suggest that the most leading statement teachers have knowledge in: Giving clear explanation before practical work, collecting animal and plant for Biology practical work and Defining problem (topic) in simple language or Collecting animal and plant for Biology practical work, with the highest mean score of (means = 2.95 and 2.92) with standard deviation of (std = 0.23 and 0.28*)* respectively**.** Again, Table 3, biology teachers mean score on their knowledge in the use of laboratory practices in teaching and learning ranged from 2.16 to 2.95. All the items had mean scores above 2.0, which indicate that respondents had positive knowledge in the use of laboratory

practices in teaching and learning. Almost all the respondents (91.9 %) liked the use of laboratory practices in teaching and learning.

In short, the knowledge level of Senior High School Biology teachers in the use of laboratory practices for teaching and learning in Jirapa municipality in the upper west Region of Ghana was high and positive which moderately influenced their attitudes toward laboratory practices. As a result, this gave biology teachers confidences toward laboratory practices.

4.3 Research Question two

The results of the biology teacher's attitude towards the use of laboratory practices in teaching and learning of biology is shown in Table 4.

Table 4: Biology teacher's attitude towards the use of laboratory practices

	Attitudes	Disagree	Neutral	Agree	Mean	SD
1	I like Biology practical	0(0.0%)	0(0.0%)	37(100.0%)	3.000	.000
2	I wish I don't have Biology so often.	32(86.5%)	1(2.7%)	4(10.8%)	1.243	.641
3	Biology practical helps me to teach theory well in class	1(2.7%)	2(5.4%)	34(91.9%)	2.892	.393
4	Biology practical motivates students	5(13.51%)	2(5.4%)	30(81.1%)	2.676	.709
5	I like to expose my students more to science equipment during practical	0(0.0%)	1(2.7%)	36(97.3%)	2.973	.164
6	I like working with science equipment despite the problems I have using them	4(10.8%)	4(10.8%)	29(78.4%)	2.676	.669
7	Biology practical make me appreciate Biology better	1(2.7%)	0(0.0%)	36(97.3%)	2.946	.329
8	Writing up Biology practical is a very useful exercise to me	0(0.0%)	2(5.4%)	35(94.6%)	2.946	.229
9	Biology practical helps me acquire scientific skills	0(0.0%)	3(8.1%)	34(91.9%)	2.919	.277
10	Biology practical is boring	33(89.2%)	3(8.1%)	1(2.7%)	1.135	.419
	AVERAGE				2.560	0.35

Source: Field Work, 2021

The results as indicated in Table 4 show that on attitude I like Biology practical, 37 (100%) of the respondents were agree with the statement while 0(0.0%) respondents were uncertain and disagree to the issue. On the second attitude: I wish I don't have Biology so often, 4 (10.8%) of the respondents agree with the statement, 1 (2.7 %) respondent were undefined with the issue while 32 (86.5%) of the respondents were disagree to the statement. The teachers wish to have frequent biology lessons. On the third attitude: Biology practical helps me to teach theory well in class, 34 (91.9%) of the respondents agree with the statement, 2 (5.4%) respondents were neutral to the statement while 1 (2.7%) of the respondent is disagreed to that attitude. On the fourth attitude: Biology practical motivates students, 30 (81.1%) of the respondent is agreed with the statement, 2 (5.4%) respondents uncertain with the issue at hand while 5 (13.51%) of the respondents were disagree to the statement. The fifth attitude: I like to expose my students more to science equipment during practical, 36 (97.3%) of the respondents agree with the statement, 1 (2.7%) teacher was neutral while 0 (00.0%) of the respondents were disagree to the statement. The sixth attitude: I like working with science equipment despite the problems I have using them, 29 (78.4%) of the respondents agree with the statement, 4 (10.8%) respondents were neutral while 4 (10.8%) of the respondents were disagree to the issue. The seventh attitude: Biology practical make me appreciate Biology better, 36 (97.3%) of the respondents agree with the statement, 0 (0.0%) respondents were neutral while 1 (2.7%) of the respondents were disagree to the attitude.

The eighth attitude: writing up biology practical is a very useful exercise to me, 35 (94.6%) of the respondents were agree with the statement, 2 (5.4%) respondents uncertain with the issue at hand while 0 (00.0%) of the respondents were disagree to the attitude. The ninth attitude: Biology practical helps me acquire scientific skills, 34

(91.9%) of the respondents agree with the statement, 3 (8.1%) respondents were undefined with the issue while 0 (00.0%) of the respondents were disagree to the issue at hand. The tenth attitude: Biology practical is boring, 1 (2.7%) of the respondent agree with the statement, 3 (8.1%) respondents were neutral to the statement while 33 (89.2%) of the respondents disagreed to the attitude towards the use of laboratory practices in teaching and learning of biology. This implies that biology practical is not boring hence motivates them.

The mean scores in the table 4 suggest that the most leading attitude towards the use of laboratory practices in teaching and learning of biology are attitudes*:* I like Biology practical and I like to expose my students more to science equipment during practical with the highest mean score of (means = *3.00* and 2.97) with standard deviation of (std = *0.00* and 0.164*)* respectively.

In summary, biology teachers mean score on their attitudes towards the use of laboratory practices in teaching and learning ranged from 1.135 to 3.00. Nearly all the items had mean scores above 1.5. One of the items had their mean scores 3.0. All the respondents (100 %) liked Biology practical work. This, in sum suggested that respondents were found to possess positive attitudes toward organising biology practical work.

4.4 Research Question three

To find out the extent biology teachers in the selected SHS use laboratory practices in teaching, thirteen questions were raised by the researcher to solicit information using the Likert scale method as presented in Table 5.

Table 5: The extend to biology teachers in the selected SHS use laboratory practices in teaching

SN	Laboratory Practices	Disagree	Neutral	Agree	Mean	SD
1.	Teacher set up practical work for students	3(8.1%)	7(18.9%)	27(73.0%)	2.649	.633
2.	Teacher gives clear explanation before practical work	0(0.0%)	0(0.0%)	37(100%)	3.000	.000
3.	Teacher teaches theory before practical work	0(0.0%)	0(0.0%)	37(100%)	3.000	.000
4.	Teacher provides enough items/equipment during practical lessons	5(13.5%)	7(18.9%)	25(67.6%)	2.541	.730
5.	Students work in group during practical lessons	5(13.5%)	2(5.4%)	30(81.1%)	2.676	.709
6.	Teacher marks students' work and provide immediate feedback	1(2.7%)	3(8.1%)	33(89.2%)	2.865	.419
7.	Teacher guides students during Biology practical lessons	0(0.0%)	0(0.0%)	37(100%)	3.000	.000
8.	Students follow rules and regulations in their drawing	6(16.2%)	4(10.8%)	27(73.0%)	2.568	.765
9.	Students are given enough time to complete tasks	10(27.0%)	10(27.0%)	17(45.9%)	2.189	.845
10.	Students use the right equipment during practical work	9(24.3%)	11(29.7%)	17(45.9%)	1.784	.821
11.	Teacher links concrete and abstract experiences of students	0(0.0%)	2(5.4%)	35(94.6%)	2.946	.229
12.	Teacher collects animal and plant specimens for Biology teaching	1(2.7%)	3(8.1%)	33(89.2%)	2.865	.419
13.	Teacher supervises students while performing practical tasks	0(0.0%)	0(0.0%)	37(100%)	3.000	.000
	AVERAGE				2.69	0.42

Source: Field Work, 2021

The results as indicated in Table 5 show that of the extend to biology teachers in the selected SHS use laboratory practices in teaching. On the first laboratory Practice: Teacher set up practical work for students, 3 (8.1%) of the respondents were disagreed with the statement, 7 (18.9%) biology teachers were uncertain with the statement while 27 (94.6%) of the respondents agreed to the statement. On the second laboratory Practice: Teacher gives clear explanation before practical work, 0 (0.0%) of the respondents were disagreed and neutral with the statement while 100 (100.0%) of the respondents were agreed to the question. On the third laboratory Practice: Teacher teaches theory before practical work, 0 (0.0%) of the respondents were disagreed and uncertain with the statement whereas 100 (100.0%) of the respondents were agreed to the issue. On the fourth laboratory Practice: Teacher provides enough items/equipment during practical lessons, 5 (13.5%) of the respondents were disagreed with the statement, 7 (18.9%) respondents were uncertain with the issue at hand while 25 (67%) of the respondents were agreed to the statement. On the fifth laboratory Practice: Students work in group during practical lessons, 5 (13.5%) of the respondents were disagreed with the statement, 2 (5.4%) biology teachers were neutral with the issue at hand while 30 (81.1%) of the respondents were agreed to the issue. On the sixth Laboratory Practice: Teacher marks students' work and provide immediate feedback, 1 (2.7%) of the respondents were disagreed with the statement, 3 (8.1%) of the respondents were uncertain with the statement while 33 (89.2%) of the respondents were agreed to the issue. On the seventh laboratory practice: Teacher guides students during Biology practical lessons, 0 (0.0%) of the respondents were for both disagreed and neutral whereas 37 (100.0%) of the respondents were agreed to the issue. On the eighth laboratory practice: Students follow rules and regulations in their drawing, 6 (16.2%) of the respondents were disagreed with the statement, 4 (10.8%)

of the teachers were neutral with the matter while 27 (73.0%) of the respondents were agreed to the question. On the ninth laboratory practice: Students are given enough time to complete tasks, 10 (27.0%) of the respondents disagreed and undecided with the statement whereas 17 (45.9%) of the respondents were agreed to the issue. On the tenth laboratory practice: Students use the right equipment during practical work, 9(24.3%) of the respondents were disagreed with the statement, 11 (29.7%) respondents were uncertain with the issue at hand while 17(45.9%) of the respondents were agreed to the statement. On the eleventh laboratory Practice: Teacher links concrete and abstract experiences of students, 0 (0.0%) of the respondents were disagreed with the statement, 2 (5.4%) respondents were uncertain with the issue at hand while 35 (94.6%) of the respondents were agreed to the statement. On the twelfth laboratory Practice: Teacher collects animal and plant specimens for Biology teaching, 1 (2.7%) of the respondents were disagreed with the statement, 3 (8.1%) biology teachers were neutral with the issue at hand while 33 (89.2%) of the respondents were agreed to the issue. On the thirteenth laboratory practice: Teacher supervises students while performing practical tasks, 0(0.0%) of the respondents disagreed and undecided with the statement whereas 37 (100%) of the respondents were agreed to the issue. The mean scores in the Table 5 suggest that the most leading statements: Giving clear explanation before practical work, Teacher teaches theory before practical work and Teacher guides students during Biology practical lessons, with the highest mean score of (means = 3.00, 3.00 and 3.00) with standard deviation of (std = 0.00, 0.00 and 0.00*)* respectively**.**

One can conclude that biology teachers gave clear explanations with regard to practical works and science theories and guide students during practical lessons.

4.4.1 Observation

The results of observation made during practical lessons conducted by a biology teacher from St. Francis Girls' SHS and a biology teacher from Ullo SHS are indicated in Table 6 below.

Table 6: Observation of a sample Biology laboratory practical lesson

SN	Laboratory Practice activity	Remarks	
		St. Francis Girls' SHS	Ullo SHS
1	Teacher set up practical work for students	√	√
2	Teacher gives clear explanation before practical work	√	√
3	Teacher teaches theory before practical work	√	√
4	Teacher provides enough items/equipment during practical lessons	√	√
5	Students work in group during practical lessons	×	×
6	Teacher marks students' work and provide immediate feedback	×	√
7	Teacher guides students during Biology practical lessons	√	√
8	Students follow rules and regulations in their drawing	√	×
9	Students are given enough time to complete tasks	×	×
10	Students use the right equipment during practical work	√	√
11	Teacher links concrete and abstract experiences of students	√	√
12	Teacher collects animal and plant specimens for Biology teaching	√	√
13	Teacher supervises students while performing practical tasks	√	√

Source: Field Work, 2021

From Table 6, respondents from the two categories of schools performed 92 % of the practical activities. Activity 5 was not performed by the participants from both categories of schools. The biology teacher from St. Francis Girls' SHS failed to mark students work and so never

provided feedback to students (Item 6). The biology teacher from an Ullo SHS school failed to help students to follow rules in drawing (Item 8) and also failed to give students sufficient time to complete task given to them (Item 9). The biology teachers from the two senior high schools carried out practical lessons for students, guided students during practical lessons, gave clear explanation before practical work, and provided enough materials during practical lessons. Furthermore, biology teachers from the two senior high schools linked concrete and abstract experiences of students, provided the materials for students during practical work and supervised practical lessons.

4.5 Research Question four

In order to pinpoint the hindrances that biology teachers face in the teaching and learning of biology, seven questions were raised by the researcher to solicit information using Likert scale method as presented in Table 7.

Table 7: The hindrances that biology teachers face in the teaching of biology

SN	Hindrances	Disagree	Neutral	Agree	Mean	SD
1	Heavy workload on biology teachers because their numbers are few	3(8.1%)	1(2.7%)	33(89.2%)	2.811	.569
2	Lack of motivation of biology teachers by the government and heads of schools	3(8.1%)	5(13.5%)	29(78.4%)	2.703	.618
3	Inadequate reagents, models and other materials for practical lessons	0(0.0%)	0(0.0%)	37(100.0%)	3.000	.000
4	Inadequate funds for biology teachers to obtain the needed reagents, specimens etc. for successful practical lessons	0(0.0%)	0(0.0%)	37(100.0%)	3.000	.000
5	The unavailability of appropriate textbooks and classroom resources	31(83.8%)	1(2.7%)	5(13.5%)	1.297	.702
6	Performance Pressure from School Administrators	18(48.6%)	10(27.0%)	9(24.3%)	1.757	.830
	AVERAGE				2.42	0.42

Source: Field Work, 2021

The results shown in Table 7 indicates that on hindrance 1: Heavy workload on biology teachers because their numbers are few, 33 (89.2%) of the respondents were agree with the statement, 1 (2.7%) of the biology teachers uncertain with the issue at hand while 3 (8.1%) of the respondents were disagree to the statement. On hindrance 2: Lack of motivation of biology teachers by the government and heads of schools, 29 (78.4%) of the respondents agree with the statement, 5 (13.5%) respondents were

undefined with the issue while 3 (8.1%) of the respondents were disagree to the issue. On hindrance 3: Inadequate reagents, models and other materials for practical lessons, 37 (100%) of the respondents agree/ agree with the statement while 0 (0.00%) respondents were neutral and disagreed. On hindrance 4: Inadequate funds for biology teachers to obtain the needed reagents, specimens etc. for successful practical lessons, 37 (100%) of the respondents agree/ agree with the statement while 0 (0.00%) respondents were neutral and disagreed. On hindrance 5: The unavailability of appropriate textbooks and classroom resources, 5 (13.5%) of the respondents agree with the statement, 1 (2.7%) teacher was neutral while 31 (83.8%) of the respondents were disagree to the issue. On hindrance 6: Performance Pressure from School Administrators, 9 (24.3%) of the respondents agree with the statement, 10 (27.0%) respondents were neutral while 18 (48.6%) of the respondents were disagree to the issue.

The mean scores in the Table 7 suggest that the most leading hindrance biology teachers faced are hindrance 3*:* Inadequate reagents, models and other materials for practical lesson and hindrance 4*:* Inadequate funds for biology teachers to obtain the needed reagents, specimens etc. for successful practical lessons with the highest mean score of (means = 3.00, 3.00) with standard deviation of (std = *0.00*, 0.00*)* respectively**.**

In short, one can draw a conclusion that many hindrances biology teachers faced in the teaching and learning of biology in the study area. Among these; inadequate reagents, models and other materials for practical lesson and inadequate funds for biology teachers to obtain the needed reagents, specimens etc. for successful practical lessons and other hindrances were observed.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Overview

This chapter presents a summary of the research findings, the conclusions drawn from the research, recommendations put forward and suggestion for further study.

5.1 Summary of the Study

This study sought to investigate the Biology Teachers' Knowledge, Attitude and use of laboratory practices of learner-centered teaching techniques in Jirapa Municipality. The literature review looked at science practical work, teaching and learning of science, methods employed by teachers in teaching the science subjects and teaching, learning environment and the challenges facing science in terms of equipment and human resources or strategies. The survey research design was used for this study. Thirty-seven biology teachers were surveyed. A questionnaire and observation schedule was used to collect data. Descriptive statistics were used to analyse the data.

It was discovered that Biology teachers in Jirapa Municipality in the Upper West Region of Ghana were mostly males and between the ages of 26years to 35years. They were professional teachers with wide-ranging years of teaching experience and had first and second degree in Biology.

The study also found that the knowledge level of Senior High School Biology teachers in the use of laboratory practices for teaching and learning in Jirapa Municipality in the Upper West Region of Ghana was high and positive which moderately influenced their attitude toward laboratory practices. As a result, biology teachers had confident toward laboratory practices.

Thirdly, the study revealed that all respondents carried out practical lessons for students and gave clear explanation before students performed practical work.

Fourthly, the study found out that biology teachers were also found to possess positive attitudes toward organising practical work in biology.

Lastly, the study found out that the hindrances biology teachers in the Jirapa Municipality faced in the teaching and learning of biology in the study area were inadequate reagents, models and other materials for practical lesson and inadequate funds for biology teachers to obtain the needed reagents, specimens etc. for successful practical lessons.

5.2 Conclusion

The following conclusions are made based on the research outcome concerning the stated objectives.

The results indicate that the knowledge level of Biology teachers in organising practical work was high. This implies that the biology teachers understood how to guide students in performing experiments and practical work procedures.

The knowledge level of biology teachers in organising field trips, which is a curricula requirement and making botanical gardens, were low.

Qualitative findings revealed that students worked in groups during practical lessons and teachers barely gave enough time for students to complete task when performing practical work, barely marked students work, and never provided immediate feedback.

The knowledge level of Biology teachers in organising practical work was high, which moderately influenced their attitude toward practical work as a result, teachers had positive attitudes toward practical work.

5.3 Recommendation

Based on the study's findings, the following recommendations are made.

1. Senior High School biology teachers in the Jirapa Municipality should make botanical gardens in their schools and should organise field trips to enhance teaching and learning.
2. Senior High School Biology teachers in the Jirapa Municipality should make students perform practical work in groups and then individual, train students to perform practical work within stipulated time, mark student's practical work and provide immediate feedback. This will make students do their corrections and perform better in Biology practical examinations.
3. The Ghana Education Service should post more female biology teachers to Senior High Schools in the Jirapa Municipality to help bridge the gender inequality among the teachers.
4. Ministry of Education, Jirapa Municipal Education office should launch science education project in the study area which focuses on school laboratory establishment and facility fulfilling as well as enhancing knowledge and skills of biology teachers.
5. A great awareness on the importance of biology science education has to be given to female students by role model professionals, educational structural organizations and science teachers.

5.4 Suggestions for further Study

The current study makes the following suggestions for further research:

Further studies on this subject can be done on attitude towards biology Learning: An exploration of Upper West Students. Again, future research is needed to investigate in more depth the Strategies and Tools Used for biology learner-centered instruction.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF SCIENCE EDUCATION

QUESTIONNAIRE FOR BIOLOGY TEACHERS

Dear Respondent

I am currently conducting research on: Biology Teachers' Knowledge, Attitude and use of laboratory practices of learner-centered teaching techniques in Jirapa Municipality. I will be very grateful if you could spare your precious time to respond to this questionnaire in order to contribute to this important process. Your identity and answers will be treated with greatest confidentiality and so I urge you to feel free to express your views. Please answer all questions.

Thank you

INSTRUCTIONS: Please tick appropriate boxes or write short sentences where necessary

SECTION A	**BIOGRAPHICAL DATA**
Gender	
Male ☐	Female ☐
Age	
18-25 ☐	26 – 35 ☐
36-45 ☐	Above 45 ☐
Academic Qualification	
Diploma ☐	First Degree ☐
Masters ☐	PHD ☐

Professional status					
Professional ☐	Non-Professional ☐				
Number of years of practice					
1-5 Years ☐	6-10 Years ☐	11-15 Years ☐	16 and above ☐		

SECTION B								
What is biology teachers' knowledge in the use of laboratory practices teaching and learning biology								
SN	**STATEMENT** **I have knowledge in:**	**1**	**2**	**3**		**Researcher's use only**		
	giving clear explanation before practical work							
	demonstrating experiment before students' carryout experiment							
	helping students to write report on experiments							
	collecting animals and plants for Biology practical work							
	helping students in making Biology models							
	arranging field trips for finding answers to students' questions							
	using interactive white board for labeling diagrams							
	linking concrete and abstract experience of							

	students							
	defining problem (topic) in simple language							
	Handling equipment							

SECTION C								
What is the biology teacher's attitude towards the use of laboratory practices in teaching and learning of biology								
SN	**STATEMENT**	**1**	**2**	**3**		**Researcher's use only**		
	I like Biology practical							
	I wish I don't have Biology so often.							
	Biology practical helps me to teach theory well in class							
	Biology practical motivates students							
	I like to expose my students more to science equipment during practical							
	I like working with science equipment despite the problems I have using them							
	Biology practical make me appreciate Biology better							
	Writing up Biology practical is a very useful exercise to me							
	Biology practical helps me acquire scientific skills							

	Biology practical is boring							

SECTION D								
To what extent do biology teachers in the selected SHS use laboratory practices in teaching								
SN	**STATEMENT**	**1**	**2**	**3**		**Researcher's use only**		
	Teacher set up practical work for students							
	Teacher gives clear explanation before practical work							
	Teacher teaches theory before practical work							
	Teacher provides enough items/equipment during practical lessons							
	Students work in group during practical lessons							
	Teacher marks students' work and provide immediate feedback							
	Teacher guides students during Biology practical lessons							
	Students follow rules and regulations in their drawing							
	Students are given enough time to complete tasks							
	Students use the right equipment during practical work							
	Teacher links concrete and abstract experiences							

	of students							
	Teacher collects animal and plant specimens for Biology teaching							
	Teacher supervises students while performing practical tasks							

SECTION E								
What are the hindrances that biology teachers face in the teaching and learning of biology								
SN	**STATEMENT**	**1**	**2**	**3**		**Researcher's use only**		
	Heavy workload on biology teachers because their numbers are few							
	Lack of motivation of biology teachers by the government and heads of schools							
	Inadequate reagents, models and other materials for practical lessons							
	Inadequate funds for biology teachers to obtain the needed reagents, specimens etc. for successful practical lessons							
	the unavailability of appropriate textbooks and classroom resources							
	Performance Pressure from School Administrators							

Key: 1 = Disagree, 2 = Neutral, 3 = Agree

THANK YOU FOR YOUR TIME

APPENDIX B

OBSERVATION SCHEDULE

Observation made during practical lessons

1. Teacher set up practical work for students.
2. Teacher gives clear explanation before practical work.
3. Teacher teaches theory before practical work.
4. Teacher provides enough items/equipment during practical lessons
5. Students work in group during practical lessons
6. Teacher marks students' work and provide immediate feedback
7. Teacher guides students during Biology practical lessons
8. Students follow rules and regulations in their biological drawings
9. Students are given enough time to complete tasks
10. Students use the right equipment during practical work
11. Teacher links concrete and abstract experiences of students
12. Teacher collects animal and plant specimens for Biology teaching
13. Teacher supervises students while performing practical tasks