MADDA WALABU UNIVERSITY

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THE PRACTICE AND CHALLENGES OF IMPLEMENTING PRACTICAL ACTIVITIES IN THE LABORATORY CLASSES OF CHEMISTRY IN SECONDARY SCHOOLS OF ADABA DISTRICT, WEST ARSI ZONE, OROMIA.

BY

KASU TADESSE ODA

JUNE 2020
ROBE –BALE/ETHIOPIA

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Declarations

This thesis is my original work and has not been submitted or in fully by any means of other person for an award of a degree in any other institutions.

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Abbreviations and Acronyms

As	Attitude Score
DVD	Digital Video Disc
EETP	Ethiopian Education Training Policy
EMA	Educational Media Agency
EPRC	Educational Policy Review Commission
ICT	Information Communication Technology
Lab	Laboratory
MoE	Ministry of Education
OFSTED	Office for Standards in Education
PCK	Pedagogical Content Knowledge
POE	Predict Observer Explain
SCRE	Science Community Representing Education
SD	Standard Deviation
SPSS	Statistical Package for Social Sciences
UNICEF	United Nation International Children's Emergency Fund
UNESCO	United Nations Educational, Scientific & Cultural Organization
WAEC	West Africa Examinations Council

Abstract

The main purpose of this research was assessing the practices and challenges of implementing practical activities in the laboratory classes of chemistry in secondary school of Adaba district. To this effect, mixed research method (both qualitative and quantitative research methods) more specifically, a concurrent triangulation strategy was employed. In Adaba district, there are 6 secondary schools. To select the samples from target population, both simple random sampling technique and purposive sampling technique were used. Consequently, 20 chemistry teachers, 356 students and 11 management of the school, generally 387 samples were taken as samples of the study. Data collection instruments like: questionnaire, interview, document analysis, and laboratory observation were used. Questionnaire were prepared for 20 chemistry teachers and 356 students, which incorporate both close-ended and open-ended questions and 6 purposively selected chemistry department heads and 11 management bodies were participants of the interview. The quantitative data was gained from different respondents using questionnaire were organized, tabulated and analyzed through frequency, percentage, mean, standard deviation, and independent t-test using 24 version SPSS software and the qualitative data were analyzed using thematic or grouping similar idea together and narrating the direct and summarized descriptions of the subject of the study. The findings of this study indicated that the most determinant constraints of practical activities in secondary schools include lack of laboratory rooms, inadequate supply of lab equipments, reagents and facilities, absence of trained laboratory technicians, lack of commitment and interest of teachers, shortage of time for practical activities, no plan and regular schedule for lab sessions, poor management, monitoring and evaluations of practical activities and practical activities did not get the necessary concern in all schools. Therefore, to bring the progress of practical activities in schools and to play a great role in initiating and supporting chemistry teaching in the laboratory, there should be done awareness creating campaigns by all stakeholders of the education system. Current and regular workshops and short term trainings about practical activities should be given to chemistry teachers in order to enhance and update their practical skills and capacities to carry out experiments and demonstrations more effectively.

Keywords*:* chemistry, practical work, practice, challenges

CHAPTER ONE

1. INTRODUCATION

1.1. Background of the Study

The most unique feature of natural sciences in comparison to other fields is that it enables experimental research, observation and inquiry and thus improves students' abilities to pose questions, develop research strategies, establish hypotheses regarding any subject and evaluate results cited (Odubunmi & Balogun, 1991).

According to (Hofstein and Lunetta, 2004) laboratory work is the basis for the science education curriculum. In addition, they stated that it is useful for students to participate in learning events comprising laboratory activities. (Tobin,1990) engaged in research on the effectiveness of learning and teaching in the science laboratory and noted that meaningful learning is possible only if students have opportunities to use appropriate equipment and materials to acquaint themselves with information regarding scientific events and concepts related with these events.

The practice in laboratory work has been a cookbook trend where the instructions are carried out like a recipe which reduces meaningful learning. The learners therefore, do not use scientific ideas to guide their actions during the practical activity and to reflect upon the data they collect. In this regard, (Kim & Chin, 2011) argue that such recipe-based practical work is not sufficient to develop students 'habits of mind' because they involve simply doing but do not require thinking through doing.

According to (Millar,2004) effective practical activities should enable students to build a bridge between what they can see and handle (hands-on), and the scientific ideas that account for their observations (minds-on). In order for chemistry laboratory work to be effective in producing meaningful learning, the teachers should develop activities that engage the learners in scientific investigations which focus their minds on the activity and its outcome. (Motswiri, 2004) observed that classroom practices in most high school Chemistry lessons are characterized by chalk-and-talk and little laboratory work.

In Ethiopia, chemistry teaching has on objectives, contents, teaching-learning methods and curriculum materials. The education and training policy of Ethiopia targets at improving educational access, quality, equity, efficiency and relevance as these were the major

educational problems of the country before 1994 (EETP,1994).As stated in the policy, objectives of the secondary school curriculum focus at enabling students to solve real life problems and to be creative and productive citizens (MoE,1994).Subsequently, to achieve these learning objectives the role of educational materials and facilities and the using if desirable approaches, strategies and methods are indispensible.

As stated in the education policy, in order to ensure quality education, there have to be adequate workshop and laboratory materials, especially in secondary schools and vocational institutions (MoE, 2010).The education and training policy of Ethiopia emphasizes the development of problem-solving capacity in the content of education, curriculum structure and approach, focusing on acquisition of chemical knowledge to be used in solving personal and societal problems. Similarly, it is stated that achieving the vision of transforming Ethiopia into a middle-income country in 2030 demands transformation of the economy through the application of chemical knowledge and technology as an instrument to create wealth Ministry of education, (MoE,2010). Thus, it is important to emphasize on chemical science and technology so as to produce capable citizens who can contribute to make the country well competitive globally through knowledge.

The prevailing problem of practical activities implementation in chemistry has a wide range of practical process. These practical processes includes the factors influencing practical activities, the ways that chemistry teachers make practical design; the way the teachers get prepared before carrying out the practical activities; the extent of the practical activities being carried out based on the guidance of teachers and the strength of the students achievements and performance for teachers .

Like other secondary schools of the country, Adaba district secondary schools are implementing practical activities in the laboratory classes of chemistry. It has acknowledged the significance of practical activities learning strategies to improve students' learning opportunities. It is very important to assess the major challenges that secondary schools are encountering in the implementation of practical activities and how schools tackle the imbalance between theoretical and practical aspects in teaching chemistry. However, there are evidences that show that practices of practical activities learning in the secondary schools of Adaba is facing with different challenges.

The major bottle neck challenges or hindering factors identified were: lack of laboratory rooms with appropriate size; lack of adequate chemicals and apparatus/equipments;

lack/deficiency of laboratory facilities such as electric light, water, students' seats and working benches; lack of laboratory technicians; lack of skill (teachers' and laboratory technicians' low laboratory skill); and lack of support.

Some of the challenges associated with chemistry practical activities may be overcome through the use of a small-scale/micro scale chemistry experimentation approach. They usually complain of lack of materials and equipment to carry out chemistry practicals and at the same time, it is possible that some of these materials and equipment may be locked up in the school laboratory store without teachers being aware of their existence.

Secondary schools in this study area, especially those have functional laboratory were using the industrial/imported chemicals and apparatus widely instead of those produced locally. The root causes for using the expensive imported materials instead of the cheap local products in the secondary schools of this study area is due to teachers' lack of experience and skill in producing and utilizing the local products. Currently, chemicals and apparatus are deficient in the secondary schools since: most of them were utilized as they served for many years; some of them were expired as they stayed in the schools beyond the fixed functioning time these chemicals, apparatuses and their spare parts are not available on market. Thus, teachers' lack of skill and experience to produce and utilize materials from the locally available resources is an additional challenge that affects the teaching-learning of chemistry practical activities.

Although, laboratory is one of the well-liked means of active learning for teaching chemistry practical activities, this large gap prevailed in this area need due attention and strong effort to reverse the condition. I have observed that practical activities implementation in the laboratory classes of chemistry and its fruitfulness is not as expected. Thus, I intend to assess the practices and challenges of implementation practical activities in the laboratory of chemistry in secondary schools of Adaba district.

1.2. Statement of the Problem

Practical work, required to teach the practical activities of the science subjects effectively, several research findings show that the practices of schools in using these methods is unsatisfactory due to different reasons. In many countries of the world, science education is suffering from a scarcity of appropriate facilities and supporting materials, including the equipment (World Bank, 1999). The World Bank research document further explained that the experiences from many developing countries demonstrate that the quality of science education is often unsatisfactory due to not only the low supply of equipments.

In Ethiopia context, there are different researches conducted on teaching practical activities. However, the focus of most of these researches is either on college of teacher's education, university, and secondary schools. For example, (Belay, 2012) tried to evaluate the design of the laboratory activities and students practical performance in Haramaya University. (Tolosa, 2015) assessed student's ability in doing laboratory practical work on analytical chemistry in Kamise College of teacher's education. (Mathewos, 2016) tried to examine factors influencing practical work in chemistry secondary schools in Wolaita.

There has been little research done on practical work in teaching chemistry on Ethiopia secondary schools. (Mathewos, 2016) conducted a research on factors influencing practical work chemistry secondary schools in wolaita. So his research is limited to secondary schools in wolaita. Since the scope of his study was delimited only to one district, the results of his study may not be generalized to all secondary schools let alone other secondary schools of the country. In addition, rather than treating both practices and challenges of practical activities, his work has emphasized on the factors. And also, he did not incorporate teachers' attitude towards in teaching practical activities chemistry.

Based on the studies made so far, it is possible to say no one has addressed the present study directly in similar scope, objectives and with the variables of studies practice, challenges and attitudes at least to the knowledge of the researcher. Thus, the present study is different from all aforementioned studies in the following respects. Firstly, the previous researchers were conducted in other areas than the current study area; and as to my knowledge there is no research conducted under a similar topic in the current study area, that is secondary schools of Adaba district. Secondly, most of these researches focused on college of teacher's education and university education levels. The study is different in this respect because it is conducted on secondary schools of Adaba district. From this, it is possible to conclude that

there is a research gap to be filled by this study. Hence, this study assesses the practices and challenges of implementing practical activities in the laboratory of chemistry in secondary schools of Adaba district.

Hence, from my teaching experience I have been observing an academic gap between the theoretical aspects and practical activities. Students are not well equipped by practical activities and that is why the quality of graduate students decline from time to time and to assure this assumption conducting research is necessary. I believe that it is very important to assess laboratory facilities in schools, how do students participate in practical activities, what are the roles and readiness of chemistry teachers towards practical activities, the major problems or constraints that secondary schools are encountering in implementation of practical activities and how schools tackle out the imbalance between theoretical and practical aspects in chemistry.

1.3. Objectives of the Study

1.3.1. General Objective of the Study

The general objective of the study is to assessing the practices and challenges of implementing practical activities in the laboratory classes of chemistry in secondary schools of Adaba district.

1.3.2. Specific Objectives of the Study

The study is aimed at achieving the following specific objectives.

1. To explore how the practical aspects of laboratory work are carried out in chemistry subject at secondary schools of Adaba district.
2. To understand the attitudes of teachers, students, and school principals towards practical activities in the laboratory classes of chemistry at secondary schools of Adaba district.
3. To identify the major challenges faced in practicing teaching laboratory work of chemistry in secondary schools of Adaba district.

1.4. Basic Research Question

This study was guided by the following research questions in which answers were sought based on the gathered and analyzed evidences.

1. How practical aspects of laboratory work are carried out in chemistry subject by students and teachers of secondary schools of Adaba district?
2. What are the attitudes of teachers, students, and school principals towards practical activities in laboratory classes of chemistry at secondary schools of Adaba district?
3. What are the major challenges that students and teachers of Adaba district secondary schools face while practicing and implementing of laboratory work of chemistry?

1.5 Significance of the Study

The study would have the following contributions for the students, teachers, school management bodies, researchers and other concerned bodies. Firstly, this study was helpful for teachers of the secondary schools to identify their strengths and weaknesses in implementing teaching of practical activities of chemistry, consequently attempting to improve the methods they use in practicing teaching of practical activities of chemistry. Secondly, it could provide students information about the effectiveness of practical activities

learning if they properly understood its pedagogical concept. Thus, students may be encouraged to effectively practice practical activities of chemistry. Thirdly, it may serve as input for policy makers in the education sectors to improve students' academic achievement. Lastly, it may serve as a reference for further research in the area of practical activities in teaching chemistry.

1.6. Delimitation of the Study

The need to assess practices and challenges of implementing practical activities in the laboratory of chemistry may require wider coverage of population by including other district of the west Arsi zone. However, due to time and resource constraints this study is limited to Adaba district secondary schools. It is also important to delimit the variables to be treated in this study. Thus, this study was delimited to only important variables, which include; practice of practical activities, challenges of practical activities and attitudes towards laboratory work chemistry. But the study not included variables like effect of chemistry practical's on the students performance and female and male exposed and those not exposed to chemistry practical's differ significantly in their average score. Since the study was attempt to assess the practices and challenges of implementing practical activities in the laboratory classes of chemistry in the study area.

1.7. Limitation of the Study

This study is believed to have certain constraints. Primarily, since the research was conducted in Adaba secondary schools, its result was not being generalized to the other district of west Arsi zone secondary schools. In addition, lack of sufficient recorded materials was the other limitation of this study.

1.8. Organization of the Study

The thesis was organized into five chapters. The first chapter was an introduction to the paper. It comprises background of the study, statement of the problem, objectives of the study, basic research questions, and significance of the study, delimitation and limitation of the study. Chapter two was a review literature in which attempts made to consult literatures related with the topic under investigation. Under chapter three, the researcher attempt to elaborate research methods and design of the study. In this chapter the topics that included are description of the study area, paradigm used for the study, research methods, research design, sources and types of data, sampling procedures, instruments of data collection, data

gathering procedures, validity and reliability of the instruments, methods of data analysis and ethical issues. Discussion and presentation of the major findings of the study were presented in chapter four. Lastly, conclusions and recommendations was drawn and forwarded in chapter five. Besides, on the last section there is attachment of reference materials and appendices.

1.9. Operational Definition of Key Terms

Attitudes: - A settled way of thinking or feeling about practical activities. It's the perceptions of students, teachers, principals, vice principals and cluster supervisors towards Laboratory work in chemistry teaching. It can be referred to as teachers and student's viewpoint, mindset, beliefs, etc towards practical activities to determine the choices that they make.

Challenges: - Problems in which students and teachers faced in their attempt to implement teaching laboratory work.

Implementation:-The process of putting a method to practice in a classroom by the Students and teachers. It refers to the actual use of practical activities what has been planned to do.

Laboratory: - A place where scientific work is done, a room or building fitted with apparatus for conducting scientific investigation, experiments or tests.

Practical work: -Tasks in which students observe or manipulate real objects or materials or they witness a teacher demonstration, a teaching method of laboratory skills to enhance the learning of scientific knowledge. All kinds of experimental and observational activities in science teaching. It is also referred to a lab work, if those activities take place in the laboratory.

Secondary school: - It refers to grades 9- 12 of education level.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURE

2.1. Nature and Concept of Laboratory Work

The phrase 'practical work' mean based on science education literature practical work "refers to *any* type of science teaching and learning activity in which students, working either individually or in small groups, are involved in manipulating and/ or observing real objects and materials as opposed to virtual objects and materials as those obtained from a DVD, a computer simulation, or even from a text-based account."(Abrahams & Reiss, 2012, p. 1036).

Defining practical work in science as a "hands-on" learning experience which prompts thinking about the world in which we live. These fall into two main categories: Core activities: Investigations, laboratory procedures and techniques, and fieldwork. These "hands-on" activities support the development of practical skills and help to shape students understanding of scientific concepts and phenomena. Directly related activities: teacher demonstrations, experiencing phenomena, designing and planning investigations, analyzing results and data analysis using ICT. These are closely related to the core activities and are either a key component of an investigation or provide valuable first-hand experiences for students. A range of activities was also identified which complement, but should not be a substitute for, practical work. These complementary activities include science-related visits, surveys, presentations and role play, simulations including a use of ICT, models and modeling, group discussion, and group text-based activities (Abrahams, 2012).

Teaching chemistry is done through practical and theory work. Typically, the term practical mean experiences in school setting where students interact with materials to observe and understand the natural world. The practical are mainly done as student experiments in the laboratory and as teacher demonstrations either in laboratories or in classrooms, while the theory is often done in the classroom (Twoli, 2006). In secondary schools, laboratory activities are designed and conducted to engage students individually or in small groups and in large-group demonstration settings (teacher demonstration) (Hofstein and Mamlok, 2007).

Laboratory work is a very important feature of school science and a high proportion of lesson time is given to them. Science practical work is very much a characteristic of the school science curriculum. They have been part of school science curriculum for over a century, and their place in a chemistry lesson has often gone unquestioned (Bennet, 2003). For example,

the West African Examinations Council (WAEC) syllabus had over the years recommended that the teaching of all science subjects listed in the syllabus should be practical based, and after several decades of emphasizing the assumed importance of practical wok in science teaching and learning, the importance became elevated to the level of a dogma (Abimbola, 1994).

Chemistry practical classes are believed to help students in understanding theories and chemical principles which are difficult (Lagowski, 2002). Moreover practical offer several opportunities to students such as: handling of chemicals safely and with confidence, acquiring hands-on experience in using instruments and apparatus ,developing basic manipulative and problem solving skills, developing investigative skills, identifying chemical hazards and learning to assess and control risks associated with chemicals (Lagowski and Pickering,2002).

However, (Hofstein, 2004) argues that research has failed to show a simplistic relationship between experiences provided to the students in the laboratory and learning chemistry. There are concerns about the effectiveness of laboratory work in helping the students understand the various aspects of scientific investigation (Lazarowitz and Tamir, 1994). Teachers usually want to develop student's higher order thinking skills, like critical thinking through laboratory work; but to what extent they can achieve this is controversial (Ottander and Grelsson, 2006).Therefore, it is important to analyze the purposes related to laboratory work, as the purposes need to be well understand and defined by teachers and students alike for the Chemistry practical's to be effective.

Traditionally, chemistry subject at all levels have included instruction in laboratory settings where students follow procedures directing them to mix chemicals, make measurements, analyze data, and draw conclusions. At the elementary, secondary, and early college levels, chemistry practical's frequently consists of what is generally described as "cook-book" exercises (Shakhashiri, 2009).

2.2. Elements of Laboratory Work

The idea is that students are taught to carry out their own scientific enquiries and so acquire scientific knowledge for themselves. Clearly practical work has a central role in any such vision of science education unlike scientific knowledge, where there is consensus about core knowledge claims, there is rather less agreement about the characteristic features of scientific

enquiry and scientific reasoning. In one sense, professional scientists clearly know more 'about science' than any other group, but their knowledge is often largely tacit 'knowledge in action' rather than declarative, propositional knowledge.

The eminent philosopher of science, Imre Lakatos, once memorably commented of scientists' explicit knowledge of their practices that 'most scientists tend to understand little more *about* science than fish about hydrodynamics' (Lakatos, 1970: 148). But the views of philosophers of science also differ, as do those of science educators, certainly at the level of detail and perhaps more fundamentally. Such conceptual framework has been categorized into essential elements for practical work: learning science as constructivist view, developing scientific knowledge, involve action and reflection, links between two domains of knowledge and alternatives to practical work (Millar,2004).

2.2.1. Learning science: a constructivist view

The scientific knowledge we want to teach in school science is consensually agreed and beyond reasonable dispute, might be read as implying a 'transmission' view of teaching and learning that the aim is to 'transfer' the knowledge initially in the teacher's mind into those of the students. But this does not follow. Where the teaching of abstract ideas is involved, transmission simply does not work. The learner must play an active role in 'taking on' the new knowledge. He or she has to 'make sense' of the experiences and discourse of the science class, and use it to 'construct meaning'. In this essentially constructivist view of learning, however, the knowledge that we want the students to construct is already known to the teacher throughout. The teaching laboratory is therefore very different from the research laboratory, as (Newman, 1982) points out.

The young child is often thought of as a little scientist exploring the world and discovering the principles of its operation. We often forget that while the scientist is working on the border of human knowledge and is finding out things that nobody yet knows, the child is finding out precisely what everybody already knows. Learning science at the school level is not the discovery or construction of ideas that are new and unknown. Rather it is making what others already know your own. The difference, from a cognitive perspective, is like that between solving a puzzle and having the solution explained to you by someone who already knows it.

An implication of this viewpoint is that practical tasks to develop students' scientific knowledge should be seen, and judged, as acts of communication and not as opportunities for enquiry. The primary criterion which a practical task of this sort should satisfy is that it is an effective means of communicating the ideas it is intended to convey. How, we might ask, and how effectively, does it augment other forms of communication (verbal, graphical, pictorial, and symbolic) that teachers might use. By 'communication' here, I do not simply means acts of 'telling', but the whole range of activities that a teacher plans to encourage and support students as they attempt to construct personal meanings that are more closely aligned with the accepted scientific view.

2.2.2. Developing students' scientific knowledge

Given that the subject matter of science is the material world, it seems natural, and rather obvious, that learning science should involve seeing, handling and manipulating real objects and materials, and that teaching science will involve acts of 'showing' as well as of 'telling'. The central question about knowledge and cognition is: how, exactly, do we (humans) get the world inside our heads? In other words, how do we construct representations of the external world which enable us to live successfully in it, and act successfully upon it when we need or wish to? One influential answer to this is provided by the work of Jean Piaget.

Piaget argues that we construct increasingly sophisticated and powerful representations of the world by acting on it in the light of our current understandings, and modifying these in the light of the data this generates. Through action on the world, we generate sensory data which can either be *assimilated* into existing schemas or require that these be changed to *accommodate* the new data, in order to re-establish *equilibrium* between the internal and external realities. Through such action, we construct a view of the objects that exist in the world, what they are made of and what can be made from them, what they can do and what can be done to them. If Piaget is correct, then practical experience of observing and (even more important) intervening in the world is essential for understanding (Millar, 2004).

The account above may tend to make understanding seem a personal matter the individual constructing his/her own representations of the world though action on it. Indeed Piaget's view has been criticized on these grounds. In practice, the representations we construct are tested out not only through action, but also through interpersonal interaction. We talk about how we see things. We bounce our ideas off others, and have them bounce theirs off us. Our ideas are consolidated where they agree with others' and challenged where they differ.

Through social interaction, our ideas are modified and refined and so are shaped towards a shared set that makes discourse and collaborative action possible.

2.2.3. Involves action and reflection

Laboratory work as any teaching and learning activity which involves at some point the students in observing or manipulating real objects and materials. It is clear from the discussion above, and also widely recognized by science educators, that much of the learning associated with a practical activity takes place through the process of talking about the observations and measurements that have been made, and what they might mean, both with other learners in the class and with the teacher. So a typical practical activity will be followed by a period of discussion of the observations and measurements made, of patterns in them (such as similarities, differences, correlations and trends), and of how they might be interpreted and explained. This is so closely linked to the preceding practical activity that it does not make much sense to separate them and regard them as two distinct teaching and learning activities even if, for practical reasons, the discussion takes place in a subsequent lesson, or in a different place (a classroom rather than a laboratory). Instead, we should see the whole activity the data collection phase and the data interpretation phase as constituting a practical task.

The teacher is, in effect, saying ‘see it my way’ (Ogborn et al., 1996). This is at the heart of all science learning and practical work plays a critical role in it. We use practical work in science classes when students are unlikely to have observed the phenomenon we are interested in, or to have observed it in sufficient detail, in their everyday life. In such situations, it is essential and unique.

2.2.4. Links between two domains of knowledge

The role of laboratory work in the teaching and learning of science content is to help students make links between two ‘domains’ of knowledge: the domain of objects and observable properties and events on the one hand, and the domain of ideas on the other (Millar and et al., 2002). How this then plays itself out in practice depends on the intended learning objectives of the task. One way of classifying the objectives of a practical task intended to improve student’s scientific knowledge. To help students to: identify objects and phenomena, learn a fact, learn a concept, learn a relationship and learn a theory/model.

Many science educators have, however, expressed significant doubts about the effectiveness of practical work, as it is currently used, for teaching scientific knowledge. (Hodson, 1990), writes that: As practiced in many schools, it is ill-conceived, confused and unproductive. For many children, what goes on in the laboratory contributes little to their learning of science. At the root of the problem is the unthinking use of laboratory work. The domain of objects and observables, evidence suggests that these are as effective as many other forms of instruction. Students *do* remember observable aspects of practical tasks, often many months or even years later, particularly when the event is a striking one.

Despite the inherent difficulty of helping students to make links between observations and ideas, and the weakness of much current practice, practical work is not an 'optional extra' in developing students' understanding of scientific concepts and explanations, but a necessary component. The reason lies in Piaget's insight that it is by *acting on* the world that our ideas about it are formed and develop. Students, therefore, need to have experiences of acting on the world, in the light of a theory or model, and seeing the outcomes. Only in this way can they come to an understanding of that theory or model. The predict-observe-explain (POE) structure (White and Gunstone, 1992) discussed earlier is particularly useful, if the students already have enough theoretical understanding of the phenomenon in question to make testable predictions. In a POE task, students are first asked to predict what they would expect to happen in a given situation and to write this down, then to carry out the task and make some observations, and finally to explain what they have observed (which may or may not be what they predicted).

Strategies for improving practical work intended to develop students' scientific knowledge have a common aim – to make the students *think* as well as *act*. Effective tasks are those where students are not only 'hands on' but also 'minds on' (Duckworth, 1990). Increasing their prevalence requires first that teachers become more aware that making links between the domain of objects and observables and the domain of ideas is demanding, and then helping them to design practical tasks which take this demand more explicitly and fully into account tasks which 'scaffold' students' efforts to make these links. Give number you cannot put it as a lecture note

2.2.5. Alternatives to laboratory work

Laboratory work to develop students' scientific knowledge is replaced by non-practical learning activities, such as video-recordings of real objects and events, or computer

simulations. Video-recordings of events and processes *can* be used to let students see events that could not be produced in the school laboratory, or to view events several times in order to look closely at different aspects of them. But they cannot wholly replace first hand practical experience. The fundamental reason is that a real event contains more information than any representation of it. All representations (video recordings, photographs, diagrams, verbal accounts) are selective, to a greater or lesser extent. They communicate some aspects of the event but not others. A student will get more complete data on what happens when a piece of magnesium is put into dilute hydrochloric acid, or when two solutions are added and a solid precipitate is formed by observing the real thing, than they could obtain from observing a representation. As well as they may gain still more by doing it, where there are kinesthetic aspects of the learning because of the greater attention we pay when we carry out actions ourselves. A simulation cannot, logically, provide grounds for knowledge of the world. It might, however, provide a useful preparation for an observation of a real phenomenon, by directing the students' attention to specific features of the real event (Millar, 2004).

Non-practical approaches may have more to offer. Video materials can juxtapose images of real events and processes with theoretical ideas and constructs, for example showing a chemical reaction alongside an atomic-level representation of the process, or the process of imaging by a convex lens alongside a ray diagram (Goldberg and Bendall, 1992). Similarly, well-designed computer-based teaching materials, including simulations, animations and other kinds of modeling activity, can also be very useful in helping students to operate in the domain of ideas. For example, a software tool under development by the Gatsby Science Enhancement Project illustrates a way of helping student's link observations of simple laboratory events to a model of energy transfers.

2.3. Benefits of Laboratory Work

Laboratory work is essential for giving students a 'feel' for the problematic of measurement, and an appreciation of the ever-presence of uncertainty (or measurement error). It is also an important tool for teaching about experimental design. According to (Quinn,2004) laboratory practices are summarized that investigative/inquiry based to develop students potentials: understanding of concepts, scientific applications, scientific attitudes, practical skills, problem solving abilities, scientific habits of mind, understanding how science and scientists work, ability to formulate scientific questions, ability to form hypotheses, ability to design

and conduct investigations, ability to formulate and revise scientific explanations, communication skills and/or ability to defend scientific arguments, interest and motivation, skills in teamwork, imagination and creativity and technical skills in the use of equipments.

As (Tesfaye, 2009) described for an effective science teaching, theory and practical activities must support to each other to form an integrated experience. So, this makes teaching science more interesting, live and participatory for better understanding and long lasting knowledge. There are several functions for science teaching which can best be fulfilled through practical activities. (Kerr, 1993) has listed the major purposes of practical works in science teaching.

- To encourage accurate observation and careful recording.
- To promote simple, common-sense, scientific methods of thought.
- To develop manipulative skills and experience.
- To give training in identification and solving of problems.
- To fit the requirements of practical examination regulations.
- To elucidate the theoretical background so as to make comprehensive.
- To verify facts and principles already taught.
- To be an integral part of the process of finding facts by investigating and arriving at principles.
- To arouse interest and maintain in the subject.
- To make biological, chemical and physical phenomena/events more real and tangible through actual experience.

2.4. Practical Works and the Science Curriculum

In the United States, and in other countries, scientists in higher (tertiary level) education have been very influential in the design and implementation of science curricula (Fensham, 1992). Yet, studies of freshman level university courses in the natural sciences showed that these courses had changed only slightly in style from university courses offered in the 1960s. Furthermore, teaching in university level courses has a powerful influence on the education, socialization, and subsequent behavior of science teachers at secondary and elementary school levels. Fensham claimed that the dominant perception of university science faculty members have been agreed that the principal goal of secondary school science education is to prepare students for success in the university level science.

“Thus, the content and knowledge of worth for secondary sciences is to be determined by the knowledge and expression of it that is now well established as the content of freshman

science courses in chemistry, biology and physics". He wrote that the attitude of many university scientists toward the science curriculum inhibited the implementation of many of the new science education goals, strategies, and sites such as science for all, inquiry, applications, and science–technology–society. In addition, competent secondary science teachers have had limited voice and power to shape curriculum and policy decisions in school science. Policy decisions are often made at state (or in the United States at district) levels where people with expertise in science teaching have had very limited voice.

As (Lunetta,2002) described, the need for meaningful, long-term professional development for science teachers on these and many related issues in science education and the need for better communication between the science education research community and the community of science teachers has become abundantly clear. Greater interaction has been inhibited, in part, by contemporary institutional structures that separate science teachers from the scientific community, from the science education research community, from meaningful professional development in science and in science pedagogy, and from participating in policy making as competent professionals.

As Ethiopia National Agency for (UNESCO, 2001), the curriculum reform has been basically government initiative although there has been pressure from the stakeholders that the system was obsolete by all standards. Thus, following the adoption of education and training policy the curricular reform became essential to achieve the new vision and mission of education in Ethiopia. The science curriculum gives more concern for science fields such as Biology Chemistry and Physics in order to produce competent scientists, engineers and medical doctors. So, to make science teaching effective it should be supported by the practical works as stated in the curriculum.

2.5. Practical Work in Science Education in Ethiopia.

In Ethiopia different types of curriculum were developed since the beginning of traditional education (4^{th} century – 1908) to modern education (1908- post 1991) (Woube, 2005). So, a frequent change of the curriculum from government to government due to various reasons has direct or indirect influence on science teaching as well as on practical works.

The science commission formed in the seminar held at Addis Ababa in January 1967 (Madsen, 1968) revised the area of general science as well as the three pure sciences this are Biology, Chemistry and Physics. According to the commission a number of handicaps to

efficient instruction were listed and registered. These are inadequate lab facilities, inadequate supplies (often due to administrative carelessness), improper scheduling, lack of reference book and library facilities (due to poor administrative procedure), etc. Concerning this, (Solomon, 2007) pointed out that there are a lot of resemblances between how the curriculum was implemented in the 1960s or 1970s and now a days. It has been observed lack of teaching materials and qualified teachers as well as language problems. Furthermore, the Education Policy itself admits the problems in those inadequate facilities, insufficient training of teachers, overcrowded classes, shortage of books and other teaching materials; all these indicate the low quality of education provided in Ethiopian schools (MoE, 1994).

Modern science and technology can help to promote economic and social growth more in the poor but developing countries like Ethiopia. In this regard, Ethiopia gives more concern to the sector and as one of the objectives of education of the country. The statement written in the policy document (MoE, 1994b:7-8) is quoted as below.

"Bring up citizens who differentiate harmful practices from useful ones, who seek and stand for truth, appreciate aesthetics and show positive attitudes towards the development and dissemination of science and technology in society."

Despite of the policy intention to make science relevant, practical and suitable for the majority of people, much of the science taught in Ethiopia remains very much concerned with rote learning of factual knowledge. The passing of examinations predominantly valuing remember of knowledge even though, in science education the ambition is to device a curriculum and methods of instruction to promote learners' conceptual and procedural knowledge by closely integrating the theoretical and practical work. In relation to this view, (Tekeste, 1990) stated that science education in Ethiopia is under crisis due to irrelevant and inappropriate methods which had failed to incorporate relevant practical experience.

In general, in this modern world, having strong background in science fields such as Biology, Chemistry and Physics seems very crucial in getting into many careers and occupations like medical science, pharmacology, engineering and other technological oriented areas. Integrating theoretical knowledge with frequent practical activities in all subject of science and advancing science and technology in this rapidly changing world should be a great concern and the primary task of developing countries like Ethiopia to reduce poverty and to realize sustainable economic development.

2.6. Major Challenges for Implementing Practical Activities in Secondary Schools

Like all other teaching methods, there are challenges to practical work. Most of the challenges of practical work came from not being able to implement the practical activities structures carefully. The following are some of the challenges of practical activities.

2.6.1. Availability of Facilities and Equipment

The place of experimental work in laboratories has always assumed a high profile at all levels of chemical education (Reid & Shah, 2007). Laboratory classes are an ideal place to integrate the active learning approach. Science laboratories have long played a unique role in science education, providing an opportunity for inquiry-based investigative learning (Hofstein & Lunetta, 2004).The modern laboratory provides students opportunities to learn specific procedures and instrumentation and to develop skills such as problem-solving and communication (Carnduff & Reid, 2003).

In secondary schools where the provision of science laboratories is less than satisfactory, the teaching and learning of chemistry is hindered in a number of ways:

i. When classes are not taught in these specialized rooms, the opportunities to investigate and engage in chemistry practical's are reduced, and hence the effectiveness of teaching, and
ii. Timetabling difficulties make the nature and frequency of chemistry power you practical's and learning more difficult to manage.

There is a clear need for the standards of accommodation to be improved and improvement of laboratory stock. If the nature and quality of chemistry practicals are to improve, then there is a continuing need for the upgrading and refurbishment of laboratories, and for new laboratories to be built in schools (Ofsted, 2005). Some barriers to effective chemistry practical have associated with facilities include: too many students in practical classes and the associated behavioral problems; insufficient funding being devolved to science departments; under resourced and old fashioned.

2.6.2. Poor Understanding and Grasp of Practical Concepts by Learners

This was attributed to stem from student's entry behavior. (Jennings,1998) in his statements on the goals of science education states that science and its processes should provide an opportunity for learners to develop thinking and process skills which include deductive,

logical and hypothetical thinking. As such due to poor grasp and understanding of practical concepts by learners these goals are hardly achieved.

2.6.3. Lack of Laboratories in Schools

In many high schools there are no laboratories at all. (Solomon, 1987) observes that science teaching must take place in the laboratory, about that at least there is no controversy. Science simply belongs there as naturally as cooking belongs to the kitchen. From this it is evident that without a laboratory it is difficult for teachers to engage students in practical activities, impacting negatively on instruction.

2.6.4 Limited Space in the Laboratory

Some schools had comparatively smaller laboratories that could not accommodate a standard class of up to forty students. Schools laboratories' should be big enough to allow practical activities to be done by all students at the same time other than doing it shifts in the case of smaller laboratories.

2.6.5. Poor Organization and Management of the Laboratory

Practical activity is crucial in schools where natural science subject have been taught as a subject (EMA, 2002). In order to conduct laboratory work the first thing is the presence of a functional laboratory. Even though, some schools have a good laboratory class room, they will face other problems like lack of well-trained technicians and teachers, lack of lab equipments and lack of effective organization and management of laboratory. Hence, organization of a laboratory is very important procedure for the effectiveness of science teaching with the help of practical works.

2.6.6 Single Science Laboratory

In some high schools there is a single laboratory serving all the sciences. In such cases the time allocated for each science subject cannot sufficiently provide for the day to day practical activities. Some scholars noted that the single science laboratory system was better suited to the already phased out secondary school curriculum that incorporated physical and biological sciences.

2.6.7. Lack of Well-trained Lab-technicians and Teachers

An effective science teaching in secondary school is mainly based on experiments and demonstrations along with other practical activities that are performed either in the laboratory or inside and outside the classroom. Teachers' role is very important for involvement of students in practical activities.

As (Kerr, 1963) identified that the most commonly mentioned factor for limiting the effectiveness of a practical work is the absence of a trained laboratory assistant/lab technician. In addition science teachers should know well the subject matter they teach and lab activities that are planned to be carried out by the students. They should give clear emphasis to their students in order to perform practical activities without any ambiguity and confusion. However, most science teachers in preparatory/secondary schools either don't have interest or don't have ability or skill to help students in doing practical work. So, teachers should get up to date training and workshop about practical activities.

2.6.8. Inadequate Textbooks/Practical Guides

There is a well-known a shortage of chemistry text books and practical guides. Effectiveness in chemistry laboratory instruction requires that learners be provided with enough practical guides and textbooks. These resources give a wide range of practical activities together with detailed procedures to be followed hence make better practical instruction.

2.6.9. Large Class Size and Inadequate Time Allocation

As (Tesfaye,2009) explained in his thesis, normally, it is assumed that number of students per class should be limited and manageable by the teacher in order to follow and check up every activity that the teacher teaches and disseminates to the students. This becomes more essential for science teaching and to carry out practical activities as planned by the teacher when the number of students per class is manageable. So, to make effective demonstration in the class and carrying out experiments in the laboratory the students must be grouped in small number and the chance of each student to involve in the practical activity will be high and the students will gain more exposure and experience sharing. On the other hand, as the number of students increases the opportunity of each student to participate in the group becomes low.

2.6.10 Minimal or No Funds Allocated for Purchase Repair and Maintenance of Laboratory Equipment

In a number of schools some apparatus in use were in very poor working conditions while others had been grounded, this impacts negatively on practical instruction. Because a number of schools they don't plan budget for laboratory equipment or there is no enough budget to purchase laboratory equipment and chemicals.

2.6.11. Students Assessment Strategies

As (Tesfaye, 2009) described "the assessment strategies practiced in the school play a great role in enhancing the practical work performed in science subject. Practical examinations are one of the main factors influencing, the importance to which experimentation is put in science teaching. Technique, attention and accuracy, lay out of results, estimation of error and above all, 'getting the right answer' were the factors commonly rated in the making of candidates' work of practical examinations. Without an examination a serious neglect of practical work can occur."

2.6.12. Some Teachers Avoided Practical Instruction as they Choose for Other Instructional Methods.

This trend is detrimental to chemistry teaching and learning, being a chemistry instruction should be practical oriented. Most teachers only focused on theoretical part they don't do the practical work, but on the text book there are many experiments and practical activities.

2.7. Theories Supporting Laboratory Work

The study was guided by the constructivist leaning theory as postulated by John Dewey who noted that humans generate knowledge and meaning from their experiences (Dewey, 1938) & (Bruner, 1960). The theory describes learning as an active, internal process of constructing new understandings. It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences.

The constructivist model suggests that learners construct their ideas and understanding on the basis of series of personal experiences. Learning science at school level is not discovery or construction of ideas that are new and unknown to learners rather it is making what others already know your own (Millar,2004). Experiences given during chemistry practical's can provide such opportunities for chemistry students. For example, (Barton, 2004) suggests that,

after an illustrative chemistry practical, students are offered explanations, models and analogies from the teacher to help them in their efforts to construct their own understanding of what they have experienced. The primary criterion which a practical activity should satisfy is that of being an effective means of communicating the ideas it is intended to convey. This study is asking how this happens in school chemistry practicals and how effectively this augments other forms of communication (verbal, pictorial, symbolic) that teachers might use.

Also, (Tobin, 1990) and (Ikeobi, 2004), report that meaningful learning is possible from a given laboratory experiments if the students are given sufficient opportunities to operate equipments and materials that help them to construct their knowledge of phenomena and related scientific concepts. The construction of deep scientific knowledge results from actively practicing science in structured learning environments, that is, where the nature and quality of laboratory activities are taken into consideration. In general, this theory stresses the significance of learners' active involvement in the process of teaching and learning so as to make learning easy and to enable them to construct their knowledge.

From the above discussion on theories related to practical work, Constructivism seems more appropriate theory for the study. It is because practical work requires students to learn through their ideas and understanding on basis of series of personal experiences to construct knowledge. Practical work requires student's active participants in constructing their own knowledge and in learning to use that knowledge to analyze scientific processes. This makes the theory preferable for this study.

2.8. Conceptual Frameworks of the Study

The researcher has developed the conceptual framework for this study. Practices of implementing practical activities in the laboratory classes of chemistry and challenges of implementing practical activities in the laboratory classes of chemistry are the dependent variables of the study. A successful implementation of practical activities depends up on the extent to which elements of laboratory work are applied. Thus the elements of laboratory work are the independent variables of practices of chemistry practical activities. Students' and teachers' efforts were assessed to investigate the practices of chemistry practical in the secondary schools. The independent variables are attitude/perception of students and teachers and challenges of implementing practical activities in the laboratory of chemistry include variables such as, availability of equipment and chemicals, class size, absence of laboratory technical assistants, lack of manuals, low syllabus coverage, fear of chemical hazards and

methods applied in laboratory. Hence, the following figure is believed to properly show the conceptual framework of the study.

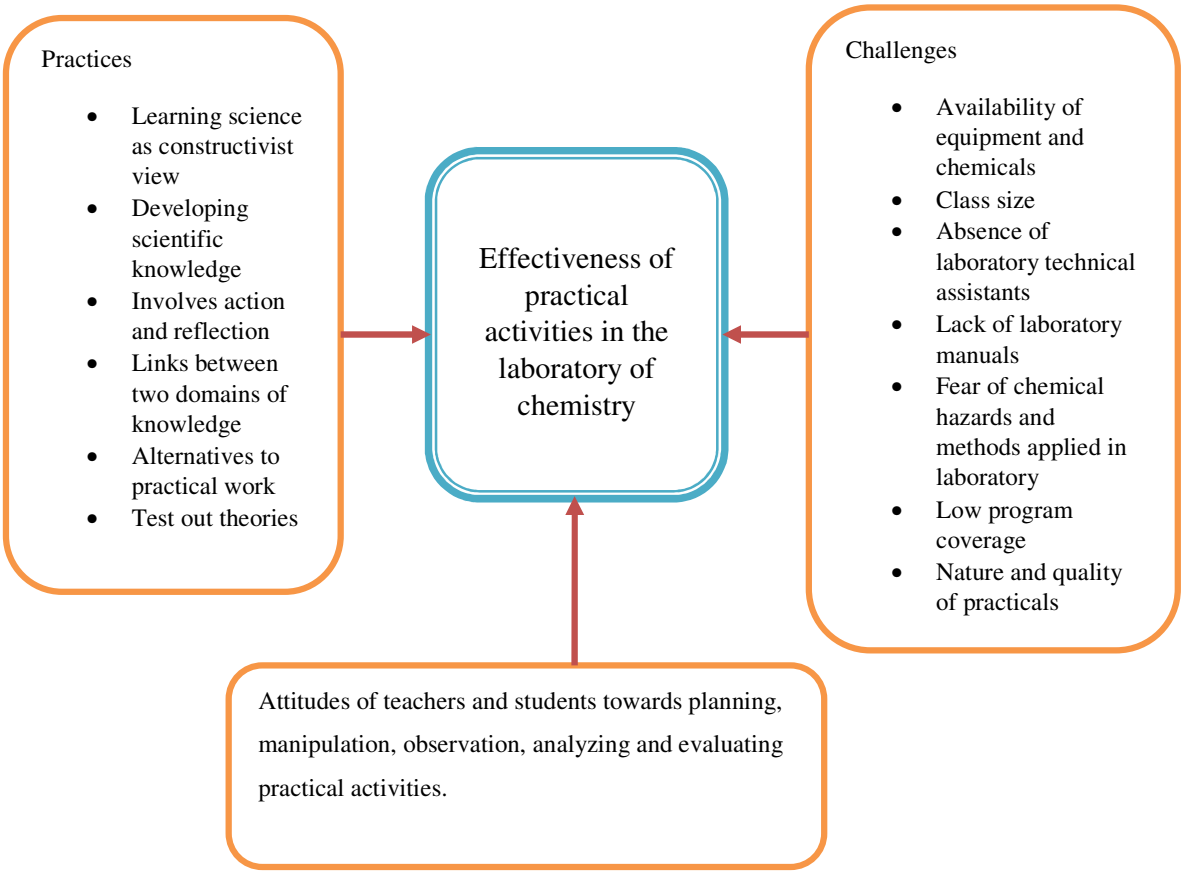

Figure-1: Graphical representation of conceptual frameworks of the study program

As shown in figure 1.Dependent variables are influenced by independent variables in many ways. Independent variables like attitude of students and teachers and challenges of implementing practical activities in teaching chemistry include: availability of equipment and chemicals, class size, absence of laboratory technical assistants, lack of manuals, fear of chemical hazards and methods applied in laboratory can affect effectiveness practices of implementing practical activities in teaching chemistry.

Nature of chemistry practical's which implies whether the lesson is a class experiment or a demonstration indicates what the students actually do in that lesson. The available resources will also determine the number of groups and their sizes into which students will be divided into. The quality of the chemistry practical's can also be affected by the number students in a class, if too many, the apparatus and reagents may not be enough for all students or the constituted groups would be too large for effective participation in the practical activity.

CHAPTER THREE

3. RESEARCH METHOD AND DESIGN

This part of the thesis presents the adopted method for this study. Thus, details about the participants, methods of data collection and samples and sampling techniques, techniques of data analysis are addressed.

3.1. Description of Study Area

Adaba is one of the district in the Oromia region of Ethiopia; it shares the name of its administrative center, Adaba as a part of west Arsi zone, Adaba is bordered on the southwest by Nensebo, on the west by Dodola, on the northwest by the Shebelle river which separates it from the Gedeb Asasa, on the east and south by Bale Zone. Adaba was located from capital town of west Arsi zone shashemne 100 Km and from capital city of country Addis Ababa 345 Km far. (Braukamper, 2002).

3.2. Paradigm of the Study

Paradigm is explained as a worldview or it is a basic set of beliefs or assumptions that guide a researcher's to investigate the problems or add new knowledge to the existing ones (Creswell, 2005). Pragmatism was selected as the appropriate research paradigm for this study. Because it is problem-oriented that takes the view that the research methods are those that help to most effectively answer the basic research questions. Therefore, making it more practical in terms of overall outcomes, practice, action and impact. And also this paradigm provides an opportunity to use different research methods, different forms of data collection and analysis in applying mixed research method. As well as, pragmatic paradigm refers to a worldview that focuses on what works rather than what might be considered absolutely and objectively true or real. Pragmatism is a deconstructive paradigm that advocates the use of mixed methods in research, sidesteps the arguable issues of truth and reality.

3.3. Research Methods of the Study

In this study, a mixed research approach, (both qualitative and quantitative methods) was employed. This is because the nature of the study involves both statistical and narrative techniques of description. Mixed approach was used to enhance the reliability of the information obtained as this is frequently advised by different researchers. In this regard, (Mujis, 2004) points out that combining quantitative and qualitative data collection methods

can often enrich our research. Moreover, mixed research method is preferred since it uses the combination of qualitative and quantitative data so that the weakness of one can be strengthened by the strengths of the other (Creswell, 2009).

3.4. Research Design of the Study

Research design is the matter of selection of sampling procedures, selection of methods of data collection and analysis, and arrangement of the research administrative procedures (Sarantakos, 1997:100). It is brief justification of research procedures, instruments of data collection and analysis, and explanations of how the research study was conducted. In this study, the concurrent triangulation strategies in which the quantitative dominates was stressed as strategy to collect and analyze data. So, the QUAN+qual approach was employed. Capitalization indicates that an approach is more emphasized.

3.5. Sources of Data

For this study, both primary and secondary data sources were used to gather pertinent data for the study. The primary sources of data are chemistry teachers, department heads, school management body (directors, cluster supervisors, vice directors) and students of Adaba district secondary schools. Secondary data was obtained from documents such as reports, annual plan, text book, reference materials and manual prepared for laboratory.

3.6. Target Population

The main objective of this study is to assess the practices and challenges of implementing practical activities in the laboratory classes of chemistry in the secondary schools of Adaba district. Because the populations in this research are chemistry teachers, department heads, School management bodies and students of secondary schools in Adaba district. Currently, there are six secondary schools in Adaba district namely Adaba secondary school, Adaba secondary and preparatory school, Wosha, Lajo, Haqo and Gededo secondary schools. In these secondary schools there are 20 chemistry teachers from this six of them are department heads of chemistry, 6 directors, 3 vice directors, 2 cluster supervisors and 3282 students.

3.7. Sample, Sample Size and Sampling Techniques

3.7.1. Sample and Sample Size

The researcher used the all population those who are supposed to meet with the objectives of the study. In this study the numbers of students are 1851 male and 1431female total of 3282, chemistry teachers totally 20 from this 18 male and 2 female and 11 managements of the school, as a population of the study. Using Yamane's (1967) sample size determination formula which is appropriate to determine sample size from a large population, the sample size for this study is computed as follows:

$$n = \frac{N}{1 + N\,(e^2)}$$

Where: n = required sample size

N = the size of population

e = margin of error at 5% (the standard value is 0.05)

Thus, the students' sample size is calculated as follows.

$$n = \frac{3282}{1+(3282)(0.05)^2} = \frac{3282}{1+(3282)(0.0025)} = \frac{3282}{1+8.205} = \frac{3282}{9.205}$$

n = 356

Thus, out of 3282 students of the Adaba district secondary schools, 356 sample students were selected to fill the questionnaire. In order to determine the sample size of teacher and school management body all of them selected, because unlike the students, the population for teachers and school management body is small, that is 31. Thus, were participants of the study.

3.7.2. Sampling Techniques

This study was conducted on chemistry teachers, school management and students of Adaba district secondary schools to assess the practices and challenges of implementing practical activities in the laboratory classes of chemistry. In order to get the required information from the study population of the secondary schools, sample respondents were selected. This is because, taking the whole populations as a target is costly and time consuming. In addition, the researcher believes that these members of the school community can provide relevant information to understand the problem under consideration.

To select the target population the researcher used both probability and non probability sampling techniques. From probability sampling, simple random technique and from non

probability sampling, purposive samplings were used from a given sample. From Simple random techniques blind folded were used because to avoid biased.

Consequently, students were selected by simple random technique, teachers and school management body selected by purposive sampling technique. In order to get the exact or the needed data which may clarify the way of the teachers in the school not only that but also to get deep information about of laboratory work in teaching chemistry of the secondary schools. The researcher used purposive sampling because of based on experience or know the group .To give equal chances and have good representative samples that fill the interview and questionnaires, simple random sampling was employed.

Table 1: Summary of total population, sample selected and sampling techniques

Schools	Students			Teachers			Principals			supervisors		
	Population	Sample	Sampling technique	Population	Sample	Sampling technique	Populatio	Sample	Sampling technique	Population	Sample	Sampling technique
Adaba secondary school	1353	146	Simple random sampling	8	8	Purposive sampling	3	3	Purposive sampling	1	1	Purposive sampling
Adaba secondary& preparatory	613	66		4	4		2	2				
Wosha secondary school	323	35		2	2		1	1				
Haqo secondary school	423	46		2	2		1	1		1	1	
Gededo secondary school	256	28		2	2		1	1				
Lajo secondary school	314	35		2	2		1	1				
Total	**3282**	**356**		**20**	**20**		**9**	**9**		**2**	**2**	

3.8. Instruments of Data Collection

In order to obtain valuable information about the practices and challenges of implementing practical activities in the laboratory classes of chemistry, data was collected from chemistry teachers, students and management body of the Adaba district secondary schools through questionnaire, interview and observation, as well as from documents analysis.

3.8.1 Questionnaire

Questionnaire is one of the most important research instruments which are simple for the respondents to indicate their responses. It is particularly appropriate to collect information from a large number of informants. Therefore, questionnaire was used to collect data from sample respondents of this study. Related likert scales questionnaire was prepared in English language for 20 chemistry teachers where six of them are department heads of chemistry and 356 students, which were incorporate both close-ended and open-ended questions.

3.8.2 Interview

The researcher believes that conducting interview was an important to gain qualitative and detailed information about the issue under investigation. A semi-structure interview were used in Afan Oromo language to make the interview sessions simple and convenient as well as to make the interview sessions friendly and to give opportunity to the participants express their views, beliefs and perception. Participants of the interview was chemistry teachers, department heads of chemistry and school management body of the secondary schools of Adaba district those have better experiences in implementing chemistry practical activities. In order to identify these teachers, the researcher requires the cooperation of department heads and management of the schools. To gather views, experiences, and attitudes of participants directly from their mouth in the natural setting. Accordingly, ten purposively selected chemistry teachers and eleven management bodies were participants of the interview.

3.8.3 Observation

In order to triangulate the information that were obtained from chemistry teachers, students and management of the schools, classroom observations was conducted. In this study the researcher employ classroom observation to gather firsthand information about the practices of practical activities. To conduct the classroom observation, the researcher uses a semi-structured checklist. This helps to record data about the actual practical activities in the lab.
The check list is prepared parallel to the basic elements of laboratory work of chemistry in mind. Therefore, six classroom and laboratory observations were conducted.

3.8.4 Document Analysis

The other technique of data collection that the researcher employed is analysis of documents related to laboratory work activities in Adaba secondary schools. Quarterly, semester and annual plan and reports of the schools that show the activities done in implementing laboratory work learning were one of the main sources of information. In addition, text book, reference materials and manuals prepared to guide the implementation activities of laboratory learning could give valuable information which help the researcher to evaluate if it is prepared based on pedagogical principles of practical activities learning.

3.9. Procedures of Data Collection

Both the quantitative and qualitative data necessary for this study were collected concurrently. This means that while distributed questionnaire for chemistry teachers and school management, the investigator undertook interview with supervisors and principals until the respondents of the questionnaire filled it in and returned it to them. Simultaneously, document analysis with observation checklist was conducted by the investigator.

3.10. Validity and Reliability of the Instruments

3.10.1. Validity of the Instruments

Validity of the research instrument is the ability of an instrument to measure what it is designed to measure. According to (Kumar, 2005), the judgment that an instrument is measuring what it is supposed to is primarily based upon the logical link between the questions and the objectives of the study. In this study, triangulation were use to enhance data validation.

The researcher used supervisors and education office experts in verifying face and content validity of the questionnaires. The supervisors and education office experts assessed the relevance of the content used in the research instruments and necessary modifications were made based on their feedback. Content validity of research instruments is judged by the researcher and experts in the field (Kumar, 2005). To further establish face and content validity of the research instruments, the researcher carried out a pilot study. The pilot study tested data collection and analysis procedures, clarity of the responses and the research assistants and ensured that the research instruments were not only valid but captured the required data.

For the pilot test sample one secondary school selected randomly, in Adaba district by comprised of teachers and students, from the designated area of study. The validity of the instruments were assured with the help of pilot testing by taking 5% of the size of sample respondents, which are 5 chemistry teachers, 2 principals and 13 students totally 20 respondents. During the pilot test, the researcher visited the selected school and reported to the principal's offices to seek authority to administer the research instruments to the teachers and the students. The pilot study was carried out to determine the difficulty level of the questionnaires so as to check the weaknesses and clarity of the questions. The result of the pilot study indicated that the instruments could be to ask for information for the study. Also

based on the results and the observation from the pilot study, the instruments were refined by modifying or eliminating in appropriate items or by adding more items to capture more information.

3.10.2 Reliability of the Instruments

Reliability of a research instrument is the degree of accuracy or precision in the measurements made by the research instrument (Kumar, 2005). Therefore, a measuring instrument is reliable if it provides consistent results (Kothari, 2004). The results from piloting were used to determine the level of the reliability of the instruments. To determine the reliability of the questionnaire, the researcher used for qualitative data constructs of transferability, dependability, conformability and trust worthiness and for quantitative data Cronbach's alpha internal consistency reliability coefficient method.

Cronbach's alpha is most commonly used when you want to assess the internal consistency of a questionnaire (or survey) that is made up of multiple likert-type scales and items. To establish whether the items on this questionnaire all reliably measure the same construct , we could ask 20 respondents pilot testing samples to complete this questionnaire, so we can calculate Cronbach's alpha based on their scores. The calculated cronbachs alpha value was compared with the most popular internal consistency reliability coefficient or cronbachs alpha value that ranged from 0 (no reliability) to 1 (perfect reliability) where the closer a scaled coefficient is to 1, the greater the reliability of the instrument. A Cronbach's alpha value of 0.75 (minimum) or higher is considered and taken as "acceptable" and guarantee the reliability of the instrument as indicated, in most social science research situation (Orodho, 2003).

Table 2. Output of reliability statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.812	.810	10

Source: - own survey, 2020

Table 2 indicate the SPSS software output of the reliability statistics table the cronbachs alpha coefficient value .81, which shows the questionnaire is reliable. Hence, the values were accepted as good indications of reliability.

On the other hand, since reliability is a necessary precondition of validity, data to be collected with different instruments were cross checked. Accordingly data that collected through questionnaire, document analysis, and interviews were triangulated.

3.11. Methods of Data Analysis

The researcher analyzed the data using both quantitative and qualitative statistical techniques since it was employed questionnaire, semi-structured interview and document analysis as data gathering tools. The data gathered through questionnaire and interview was analyzed quantitatively and qualitatively respectively. The quantitative data that gained from different respondents using questionnaire were organized, tabulated and analyzed through frequency, percentage, mean, standard deviation and T-test by using 24 version SPSS software.

Frequency and percentages were used to compute the characteristics of respondents related to sex, age, work experience, grade level and educational qualification. And also to explain the extent to which teaching practical activities in the laboratory classes of chemistry is practiced in the Adaba district secondary schools. Moreover, independent sample t-test was employed to determine whether there are significant differences between students and teachers on practice, challenges and attitudes towards implementing practical activities in the laboratory classes of chemistry in secondary schools of Adaba district.

Data analysis in qualitative studies basically involves verbal argumentations than numerical explanations. Hence the data that were collected through interview, open ended questionnaires and secondary data were analyzed using thematic or grouping similar idea together and narrating the direct and summarized descriptions of the subject of the study. Based on the data analysis, interpretations made to reach at certain findings.

Finally, the researcher employed document analysis techniques using the performance of schools, laboratory plans, lab guideline and practice, written reports on practical activities and feedback obtained to suggest the possible strategies to improve the practices of practical activities in secondary schools of Adaba district.

3.12. Ethical Issues

The ethical consideration is concerned; the researcher keeps the originality of the work. Besides, greatest care was taken to minimize the researcher's personal bias. In addition, the study subjects' reaction to the items of the research was kept confidential. Their responses were used only for study purpose. Moreover, the researcher was stick to the required formal legal procedures to conduct the study. This may include securing official letters from the concerned bodies and undertaking the task with discipline and respect.

CHAPTER FOUR

4. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

This chapter is concerned with data presentation, analysis and interpretation. It is divided into two parts where the first part deals with characteristics of respondents while the second part presents analysis of data obtained from teachers, students, principals, vise principals and cluster supervisors on practices and challenges of implementing practical activities in the laboratory classes of chemistry in secondary schools of Adaba district.

4.1. Demographic Analysis

4.1.1 Response Rate

The total of 376 questionnaires was distributed from this 356 for secondary schools students and 20 for chemistry teachers. The response rate was indicated in the table 1 below.

Table 3. Response rate

Items	Response rate	
	Number	**Percent**
Sample size	376	100 %
Collected	354	94.1%
Uncollected	22	5.9%
Total	**376**	**100%**

Source: - own survey, 2020

From the above table 3 out of 376 questionnaires distributed, 354 (94.1%) questioners were returned back during data screening. Therefore from the total of 376 questionnaires, 354 (94.1%) valid responses were used for analysis. According to (Mugenda, 2003), a return rate of 70% is considered to be good enough. Therefore, this was a good representation of the sampled respondents.

4.1.2 Characteristics of the Respondents

Those took part in responding to the questions in this study was students, chemistry teachers and school management body (directors, vise directors and cluster supervisor) of six secondary schools of Adaba district under consideration. The proportion of this population from relevant programs presented and to get clear information about respondent's characteristics related to sex, age, teaching experience, qualification and total teaching credit hours per week were examined in the following table.

Table 4.The demographic results of the students

Respondents		Male		Female		Total	
		N	**%**	**N**	**%**	**N**	**%**
Age	15-18	113	56.5	94	70.1	207	61.9
	19-22	71	35.5	30	22.4	101	30.3
	23 and above	16	8	10	7.5	26	7.8
Total		**200**	**100**	**134**	**100**	**334**	**100**
Grade level	Grade 9	45	13.47	39	11.67	84	25.1
	Grade 10	47	14.1	37	11.1	84	25.1
	Grade 11	50	14.9	32	9.58	82	24.6
	Grade 12	58	17.36	26	7.78	84	25.1
Total		**200**	**59.83**	**134**	**40.13**	**334**	**100**

Source: own survey, 2020

As it is indicated in the table 4 above, out of the total 334(100%) respondents, 207(61.9%) were in the age category of 15-18 years, 101(30.3%) and 26(7.8%) were within the range of 19-22 and 23&above years respectively. This shows that participants in the study groups were diversified in terms of age. The item 2 indicates include all grade level of secondary school almost with equal chance. The number of female participant students was 134(40.13%) and that of male students was 200(59.83%) of the participant students. This indicates that the number of female participants was less than that of male, however, the difference in the proportion of males and females had no influence on the results of the study.

Table 5. The demographic results of the teachers, principals and cluster supervisor

Item		Teachers		Principals		Vise principals		Cluster supervisor		Total	
		N	%	N	%	N	%	N	%	N	%
1.Sex	Male	18	90	6	100	3	100	2	100	29	93.5
	Female	2	10	-	-	-	-	-	-	2	6.45
	Total	**20**	**100**	**6**	**100**	**3**	**100**	**2**	**100**	**31**	**100**
2.Age in years	26-30	4	20	-	-	-	-	-	-	4	12.9
	31-35	5	25	-	-	2	66.7	-	-	7	22.6
	36-40	7	35	2	33.3	1	33.3	1	50	11	35.5
	Over 40	4	20	4	66.7	-	-	1	50	9	29
	Total	**20**	**100**	**6**	**100**	**3**	**100**	**2**	**100**	**31**	**100**
3. Recent qualification	BSC/BA	18	90	-	-	-	-	-	-	18	58.1
	MSC/MA	2	10	6	100	3	100	2	100	13	41.9
	Total	**20**	**100**	**6**	**100**	**3**	**100**	**2**	**100**	**31**	**100**
4.Teaching experience in years	3-6	3	15	-	-	-	-	-	-	3	9.7
	7-10	5	25	-	-	-	-	-	-	5	16.1
	11-14	4	20	-	-	-	-	-	-	4	12.9
	15-18	2	10	2	33.3	3	100	-	-	7	22.6
	19-22	2	10	2	33.3	-	-	1	50	5	16.1
	23and above	4	20	2	33.3	-	-	1	50	7	22.6
	Total	**20**	**100**	**6**	**100**	**3**	**100**	**2**	**100**	**31**	**100**
5.Teaching credit hours per week	10-15	4	20	-	-	-	-	-	-	-	-
	16-20	7	35	-	-	-	-	-	-	-	-
	Over 20	9	45	-	-	-	-	-	-	-	-
	Total	**20**	**100**								
6.Average number of students in class	40-50	7	17.5								
	50-60	20	50								
	Over 60	13	32.3								
	Total	**40**	**100**								

Source: own survey, 2020

As can be seen from table 5, item1 the male group constituted the overwhelming majority of participants 29(93.55%) of the all respondents while the females make up the rest 6(6.45%). From teacher participants, 18(90%) were males and 2(10%) were females. From principal 6(100%), vice principal 3(100%) and cluster supervisor 2(100%) participants were male. From the above data, one can conclude that the participation of female's teacher was low and principal ship position there is no female participants in general secondary schools of sampled area. However, the difference in the proportion of males and females had no influence on the results of the study.

As indicated in table 5, item 2 out of the total respondents, 4(12.9%) were in the age category of 26-30 years while 7(22.6%) were within the range of 31-35 years. Of the remaining participants, 11(35.5%) and 9(29%) were in the range of 36-40 and over 40 respectively. Regarding the age distribution across the groups of respondents, majority of the 7(35%) teachers were under the age of 36-40 while out of 6 principles 4(66.7%)at the age of above 40, vice principals 2(66.7%) were 31-35 and cluster supervisor 1(50%) at the age 36-40 and

1(50%) over 40. This shows that participants in the study groups were diversified in terms of age and their information are more reliable.

As can be seen in table 5 item 3, out of the total teacher respondents, 18(90%) were first-degree holders while 2(10%) were second degree qualified to teach in secondary schools as per the requirement of the education policy. On the other hand, 6 (100%) of the principles 3(100%) vise principals and 2(100%) cluster supervisor were second-degree holders which fulfilled the minimum qualification requirement to serve as principal and supervisor in secondary schools. It seems that these teachers and school managements hold a reasonable level of qualification for the secondary they work in.

As show in table 5 item 4, 3(15%) of teachers had teaching experience of 3-6 years while 5(25%), 4(20%) ,2(10%), 2(10%) and 4(20%) of the respondents had years of teaching experience between 7-10, 11-14, 15-18, 19-22 and 23 years and above respectively. This clearly shows that teachers had different years of experience, which in turn helped the student researcher to secure data from teachers with relatively long years as well as short years experience.

As can be seen from table 5 item 5, out of the total 20 (100%) teacher respondents, 4(20%), 7(35%) and 9(45%) had teaching work load of 10-15, 16-20and over 20 respectively . From the above most of secondary school teachers (80%) had work load of either 16-20 or over 20. The existing teaching load seems poor to implement practical activities of chemistry in the secondary schools under discussion where the expected normal load for each teacher at this level are 15 periods per week. The teaching load they are expected to cover in a week can also be a problem, as the teachers have inadequate time to prepare themselves for teaching practical activities, to reflect on their teaching, and to conduct research to improve their practice.

However, in item 6 they are faced with large class sizes, as the majority of the teachers either 50-60or over 60 (82.5%) seemed to be in a situation where they handled more than 50 students in a class. This could partly explain the difficulty of employing practical activities properly to reach every student in the class. Large class sizes mean this has to be managed very carefully. Possibly one way would be for the class of say 70 to be split into 10 groups of 7.In each group, one pair would carry out the practical, watched by the others. The others might evaluate the skills of the pair, using previously agreed criteria. Over time all students would do some practical activities.

4.2. Students' and Teachers Response on the Practices and Challenges of Implementation Practical Activities in the Laboratory of Chemistry in Secondary Schools

Table 6: - Analysis of students and teachers response on organization, facilities and functions of chemistry laboratory.

	Description of item	N		Response of students N (%)	Response of teachers N (%)	Mean	SD
1	To what level do you agree your school have an organized Chemistry laboratory?	354	Strongly agree	10(3%)	4(20%)	2.6	1.3
			Agree	108(32.3%)	2(10%)		
			Undecided	15(4.5%)	1(5%)		
			Disagree	174(52.1%)	6(30%)		
			Strongly disagree	27(8.1%)	7(35%)		
2	What is your agreement on our school having a separate lab room for chemistry subject?	354	Strongly agree	20(6%)	2(10%)	2.35	1.27
			Agree	82(24.6%)	2(10%)		
			Undecided	14(4.2%)	2(10%)		
			Disagree	185(55.4%)	4(20%)		
			Strongly disagree	33(9.9%)	10(50%)		
3	To what extent do you believe on functionality of chemistry laboratory in your school?	354	Agree	116(34.7%)	5(25%)	2.41	1.15
			Undecided	13(3.9%)	2(10%)		
			Disagree	170(50.9%)	5(25%)		
			Strongly disagree	35(10.5%)	8(40%)		
4	Have you ever observed/do any chemistry demonstration during the current academic year?	354	Strongly agree	13(3.9%)	1(5%)	2.34	1.2
			Agree	121(36.2%)	2(10%)		
			Undecided	15(4.5%)	2(10%)		
			Disagree	148(44.3%)	4(20%)		
			Strongly disagree	37 (11.1%)	11(55%)		
5	If your answer for question 4 is 'agreed' how many times do you involve in practical activities?	354	None	227(68%)	6(30%)	1.975	1.22
			4 times	48(14.4%)	8(40%)		
			5-7 times	16(4.8%)	3(15%)		
			7-10 times	43(12.9%)	3(15%)		
6	Are there adequate facilities such as laboratory materials and reagents in your school laboratory for chemistry practical works?	354	Strongly agree	13(3.9%)	2(10%)	2.32	1.27
			Agree	65(19.5%)	3(15%)		
			Undecided	14(4.2%)	2(10%)		
			Disagree	171(51.2%)	5(25%)		
			Strongly disagree	71(21.3%)	8(40%)		
7	To what extent do you believe that learning chemistry should be supported with practical activities?	354	Strongly agree	27(8.1%)	5(25%)	3.44	1.213
			Agree	239(71.6%)	5(25%)		
			Undecided	15(4.5%)	3(15%)		
			Disagree	41(12.3%)	3(15%)		
			Strongly disagree	12(3.6%)	4(20%)		
Valid (list wise)		354					

Note:-. * <3 = Disagree, 3 = somewhat agree, and>3 = Agree

The data in table 6, item 1 indicates that in general 124(35%) students and teachers assured the presence of an organized chemistry laboratory and 16(4.5%)respondents replied undecided and the remaining 214(60.5%) of the students and teachers responded the absence of well organized laboratory in their schools. However, the overall mean score 2.6 with SD of 1.33 indicated that majority of respondents disagree with the presence of well organized

chemistry laboratory in their schools. From this we can conclude there is lack of well organized chemistry laboratory.

Regarding the presence of organized chemistry laboratory a principal of secondary school expressed his opinion as follows:

I have been a teacher and principal in the secondary school for several years .But I did not see well organized chemistry laboratory with suitable facilities, chemical and apparatus as well as adequate electrical & water services, library resources like laboratory manuals, suitable demonstration desks, good ventilation and arrangement of the room. I know conducting needs to prove organization of laboratory concerning the practical activities; but doing so is not as such a common practice (SP1, 30/02/2020).

Responses of other school principals of secondary schools and cluster supervisor were similar toward the fact that there is no well-organized chemistry laboratory. Many scholars are of the opinion that secondary school chemistry laboratory need to fulfill supplies, equipments and reagents. These facilities for chemistry laboratory are paramount important for continuous and enormous range of experimentation, adjustment of apparatus, demonstration and laboratory equipments and supplies for on-going projects. It also requires enough space for storage and supplies as well as adequate electrical & water services, library resources like laboratory manuals, suitable demonstration desks, good ventilation and arrangement of the room (Tesfaye, 2009).

According to (Solomon, 1987) observes that science teaching must take place in the laboratory, about that at least there is no controversy. Science simply belongs there as naturally as cooking belongs to the kitchen. From this it is evident that without a laboratory it is difficult for teachers to engage students in practical activities, impacting negatively on instruction.

Data in table 6 item 2 shows that 106 (29.9%) students and teachers revealed the presence of separate laboratory classes for chemistry, Biology and Physics practical activities. It is clear that when there is a separate and large class it is suitable for both teachers and students to carry out practical activities as much as possible rather than sharing one room with other departments in science.16 (4.5%) responded undecided and 232 (65.6%) students and teachers responded that their schools have no a separate room for chemistry, Biology and physics practical activities. The mean score 2.35 with SD of 1.27 showed that majority of respondents at level of disagree with the presence separate lab for chemistry practical activities. So, absence of separate laboratory were one of constrain for practical work.

Moreover the interview from school principals and cluster supervisor added that the existence of one common laboratory room creates an overcrowding and clashing of laboratory programs and hence, there is limited period to carry out laboratory activities based on the schedule of each science discipline and this restricts teachers and students to perform laboratory session on an extended period of time. Therefore, one of the constraints for implementation of chemistry practical activities is lack of separate room for Biology, Chemistry and Physics. According to (Reid, 2003) in secondary schools there is a single laboratory serving all the sciences. In such cases the time allocated for each science subject cannot sufficiently provide for the day to day practical activities.

As table 6, item 3 shows 121(34.1%) students and teachers responded that their school laboratories are functional for practical activities. Whereas 15(4.2%) respondents undecided with the idea and 218(61.7%) students and teachers confirmed that their school laboratories are non-functional for most of the academic year and no practical activities at all. The mean score indicates that 2.41 with SD of 1.15 the level of disagree with functionality of chemistry laboratory. So, theoretical knowledge of chemistry is not supported by practical activities in these schools and this makes chemistry learning incomplete and students could not get practical skill and experience which is the core point in chemistry to determine their destination.

In supporting this interview result from school managements indicates that there is gap in the functioning of chemistry laboratory in Adaba district secondary schools. These disparities in functioning of laboratories in the schools make a difference in the knowledge and skills of students at the same grade level learning under a common umbrella of curriculum in the country. The finding of the current study was consistent with (EME, 2002) explained that in order to conduct laboratory work the first thing is the presence of a functional laboratory. Even though, some schools have a good laboratory class room, they will face other problems like lack of well-trained technicians and teachers, lack of lab equipments and lack of effective organization and management of laboratory. Hence, organization of a laboratory is very important procedure for the effectiveness of science teaching with the help of practical works.

Data from table 6 item 4 indicates that 137 (38.7%) students and teachers confirmed that they have been observed practical activities in chemistry laboratories in the current academic year.17(4.8%)respondents undecided and 200 (56.5%) reported as they did not see any laboratory activities of chemistry subject. Here, the mean score shows 2.34 with SD 1.20

which indicate that the level of disagreement which is majority of respondents respond they didn't see any laboratory activity. From this finding we can conclude that most of them are not observe any practical activities in laboratory. So these indicate that it is one of major problem faced in secondary school of sampled area.

The result of interview and open ended with chemistry department heads, principals and cluster supervisors agrees with the students' and teachers' responses. This is due to organization, facilities, teacher's interest, low follow up of concerning body and it related to lack school finance. Therefore, there is a gap no practice of allowing teachers and students conducting practical activities in the teaching-learning of chemistry practical parts almost in all of the schools under study. Hence, the secondary schools under study are deficient of the several advantages that can be obtained when students conduct chemistry practical/hands-on activities. According to (Jenkins,2003) the aims of practical works are to develop manipulative skills and techniques; to encourage accurate observation and description; to discover or illustrate a concept, law or principle; to experience scientific phenomena; to motivate by stimulating interest and enjoyment; to develop certain 'scientific attitudes' such as open-mindedness and objectivity; to develop an understanding of experimental procedures and evidence and to get a "feel" for what it is like to be a problem-solving scientist.

Data from table 6 item 5 indicates that 121(34.2%) they were able to observe or do practical activities 4-15 times.233(65.8%)students were not observe or do any practical activities. The overall mean score 1.97 with SD 1.22 showed that majority of them not done or observe any practical activities. From this finding we can conclude that almost all of them not do/observe any practical activities from their text book this indicate that sampled area of secondary schools faced with implementation practical work chemistry.

According to the interview of department heads and school principals the reason why more activities have not been conducted where there is lack of apparatus, lab technician and reagent. Supporting this science commission in the seminar held at Addis Ababa in January 1967 (Madsen, 1968) revised the area of general science as well as the three pure sciences i.e. Biology, Chemistry and Physics. According to the commission a number of handicaps to efficient instruction were listed and registered. These are inadequate lab facilities, inadequate supplies (often due to administrative carelessness), improper scheduling, lack of reference book and library facilities (due to poor administrative procedure), etc.

Data from table 6 item 6 describes that 83(23.5%) students and teachers confirmed that laboratory facilities and equipments are sufficient to conduct practical activities in chemistry subject. On the other hand 16(4.5%) were undecided and 255(72%) revealed that no adequate facilities and laboratory equipments to carry out practical activities. However, as their averages mean score 2.32 with SD of 1.27 shows that which is at the level of disagreement this indicates there is lack of adequate materials and facilities. From this result we can conclude in sampled area of secondary schools there is lack of adequate facilities such as laboratory apparatus and reagents. So this was one obstacle to implementing practical activities.

Based on the interview of, school principals and chemistry teachers it is clear that lack of adequate materials and facilities would be taken as one of the major constraints of practical activities in the Adaba district secondary schools. In accordance (Bekalo, 1999) practical work can't be taken place without having the necessary equipment, apparatus and reagents in the school laboratory. Because of this students will have few or no exposure to practical activities and that is why they become confuse, how to conduct practical activities and operating equipment as a college and university student when they completed preparatory or secondary school and have joined Universities and colleges. Therefore, lack of materials and other facilities highly restrict students to perform practical works in the laboratory and other practical activities in the classroom or in the field.

The data from table 6 item 7 shows that 276 (77.9%) students and teachers agreed that learning chemistry should be supported by frequent and regular practical works such as demonstration, experiments and field trips as well to internalize the chemistry subject and to develop permanent skill in the students. About 18 (5.1%) respond undecided and 60 (16.9%) of students and teachers disagreed the view of supporting chemistry learning with practical works. I think this is due to lack of awareness or losing hopes for practical activities as a result of a total non-functioning of laboratory activities in those schools. The above explanation is also supported by statistical analysis, since mean score 3.44 with SD of 1.21 is the level of agreement result shows the presence of the practicality of experiments and demonstrations as a tool to facilitate and apply for better and interesting chemistry teaching and learning process.

According to (Wellington, 1998) offers a general summary of arguments for learning science supported with practical activities. Affective arguments practical work, it has been argued, is

motivating and exciting it generates interest and enthusiasm. It helps learners to remember things; it helps to 'make it stick'. Skills arguments it is argued that practical work develops not only manipulative or manual, dexterity skills, but also promotes higher-level, transferable skills such as observation, measurement, prediction and inference. These transferable skills are said not only to be valuable to future scientists but also to possess general utility and vocational value.

Table 7: - Analysis of students' and teachers response on challenges, skill and contribution of chemistry practical activities.

Description of item		N		Response of Students N (%)	Response of teachers N (%)	Mean	SD
1	To what extent do you think secondary schools give attention and emphasis to practical activities	354	No commitment	189(56.6%)	5(25%)	1.96	.96
			Few commitment	115(34.4%)	8(40%)		
			It is average	12(3.6%)	2(10%)		
			Great commitment	18(5.4%)	5(25%)		
2	To what extent do you think that you have sufficient skill, experience and professional responsibility for conducting lab activities to change your understanding of chemistry practical activities?	354	Strongly agree	5(1.5%)	2(10%)	2.72	1.15
			Agree	147(44%)	4(20%)		
			Undecided	24(7.2%)	3(15%)		
			Disagree	96(28.7%)	3(15%)		
			Strongly disagree	62(18.6%)	8(40%)		
3	To what extent do you agree on the idea that practical activities should carry a certain amount of percentage from the total score/mark?	354	Strongly agree	14(4.2%)	2(10%)	2.38	1.23
			Agree	65(19.5%)	6(30%)		
			Undecided	20(6%)	1(5%)		
			Disagree	215(64.4%)	5(25%)		
			Strongly disagree	20(6%)	6(30%)		
4	Do you think using demonstration of experiments during teaching chemistry in your school?	354	Insignificant	42(12.6%)	8(40%)	2.49	1.26
			Less relevant	150(44.9%)	5(25%)		
			Undecided	12(3.6%)	2(10%)		
			Relevant	114(34.1%)	4(20%)		
			More relevant	16(4.8%)	1(5%)		
5	What is your agreement presence on well-trained laboratory technician/lab assistant at your school?	354	Strongly agree	18(5.4%)	2(10%)	2.53	1.24
			Agree	81(24.3%)	4(20%)		
			Undecided	15(4.5%)	1(5%)		
			Disagree	181(54.2%)	8(40%)		
			Strongly disagree	39(11.7%)	5(25%)		
6	What factors do you think that would affect or hinder the performance of practical work at your school?	354	Lack of apparatus	50(15%)	11(55%)	2.07	1.05
			Lack of reagents	189(56.6%)	5(25%)		
			commitment	55(16.5%)	2(10%)		
			Large class size	40(12%)	2(10%)		
7	To what extent do you think the experiments demonstrated by the computer/plasma TV replace the real experiment taking place in the class room or in the laboratory?	354	Strongly agree	14(4.2%)	2(10%)	2.50	1.30
			Agree	102(30.5%)	3(15%)		
			Undecided	18(5.4%)	3(15%)		
			Disagree	139(41.6%)	5(25%)		
			Strongly disagree	61(18.3%)	7(35%)		
8	Is there a science laboratory club (i.e. Biology, chemistry and Physics lab clubs) in your school?	354	Strongly agree	5(1.5%)	1(5%)	2.49	1.16
			Agree	124(37.1%)	3(15%)		
			Undecided	32(9.6%)	1(5%)		
			Disagree	122(36.5%)	10(50%)		
			Strongly disagree	51(15.3%)	5(25%)		

Note: - * <3 = Disagree, 3 = somewhat agree, and>3 = Agree

Concerning the commitment and readiness of secondary schools to practical activities and encourage students to actively participate in laboratory works the data in table 7, item 1 analyzed as 23 (6.5%)students and teachers revealed have great concern and commitment to

encourage and participate students in laboratory activities. However, 123(34.8%) students and teachers responded that schools have few concern and commitment to practical activities. Therefore, few practical activities are carried out and these are not satisfactory for students to get better exposure and skill from chemistry subject. As the data shows in the above table, 194(54.8%) students and teachers confirmed that schools have no any concern and commitment to practical activities at all and 14(3.9%) responds it is average. Therefore, this are disparities among teachers' and school management's body's opinion, concern, commitment and professional responsibility towards laboratory works and this were taken as one of the constraints for implementing chemistry practical work in Adaba district secondary schools.

The mean result of 1.96 with SD .96 indicates that there are significant disparities among students, teachers and school management's feelings, interests, attitudes, commitments and professional responsibilities towards practical activities implementation and encouragement of students to carry out practical works. Furthermore, the data from the interview of principals and cluster supervisor indicates that concern and commitment of teachers, students and school principals widely differ and such conditions are responsible for challenges of practical activities in Adaba district secondary schools in particular and in all educational levels in general. From this we can conclude those feelings, interests, attitudes, low concern and commitment were one of constrain to implement practical activities chemistry.

Teachers' and school management body role is very important for involvement of students in practical activities. As (Kerr, 1963) identified that the most commonly mentioned factor for limiting the effectiveness of a practical work is the absence of concern and commitment. In addition science teachers should know well the subject matter they teach and lab activities that are planned to be carried out by the students. However, most science teachers in secondary schools either don't have interest or don't have ability or skill to help students in doing practical activities. So, teachers should get up to date training and workshop about practical activities.

The data from table 7, item 2 evaluates the skill, experience and professional capacity of teachers and students to carry out practical activities. Based on the data, 158 (44.6%) students and teachers agree with that they have skill and experience to conduct and participate in chemistry laboratory activities. Whereas 27(7.6%) respondents undecided and 169 (47.8%) students and teachers disagree with the have sufficient skill and experience for conducting the

various experiments and activities listed in the text books of chemistry subject. However, the average mean score 2.72 with SD of 1.15 indicates that the level of disagree so this showed that students and teachers haven't skill and experience to conduct and participate in chemistry laboratory activities. From this result deficient of skill and experience for conducting practical activities was one of the challenge hinder in the secondary school of sampled area.

In supporting these (Jennings, 1998) in his statements on the goals of science education states that science and its processes should provide an opportunity for learners to develop thinking and process skills which include deductive, logical and hypothetical thinking. As such due to poor grasp and understanding of practical concepts by learners and teachers these goals are hardly achieved.

Regarding giving value/credit for practical activities of chemistry subject, based on the data in table 7, item 3, most students 87 (24.6%) students and teachers agree that practical activities should be regular in each semester of the academic year & it should carry certain marks from 10% - 20% of the total marks per semester.21 (5.9%) were respond undecided. Those students and teachers who disagreed with carrying of certain marks were 246(69.5%). Where the averages mean score 2.38 with SD of 1.23 indicate that the level of disagreement which is practical activities should not carry certain marks out of the total scores. From this result we can conclude that practical activities should not carry certain marks out of the total scores. Some of their reasons are no practical activities in our school at all, no facilities and equipments in the laboratory, no chance to participate in practical activities and under such circumstances how we say that a practical activity should carry certain amount of mark for it. So it is one of constrain on implementation of practical activities in chemistry.

The qualitative result from interview and open ended questions from principals and department heads showed that they don't give value whether teachers include in their mark list or not. But they agreed on practical activities should certain amount of total mark. In supporting this (Tesfaye, 2009) described "the assessment strategies practiced in the school play a great role in enhancing the practical work performed in science courses. Practical examinations are one of the main factors influencing, the importance to which experimentation is put in science teaching. Technique, attention and accuracy, lay out of results, estimation of error and above all, 'getting the right answer' were the factors commonly rated in the making of candidates' work of practical examinations. Without an examination a serious neglect of practical work can occur."

The data from table 7 item 4 evaluates using demonstration of experiments in their schools to carry out practical activities. Based on the data 50(14.1%) insufficient, 155(43.8%) less relevant, 14(3.9) undecided, 118(33.4%) relevant and 17(4.8%) more relevant. From this the overall mean score 2.49 with SD 1.26 indicate that demonstration of experiments in schools by teachers are less relevant.

The interview result shows from chemistry department head explained how his school chemistry teachers and students use laboratory as follows:

In my school, chemistry teachers mostly use teacher's demonstration method for teaching chemistry practical parts as allowing students to do the activities themselves are impossible due to inadequate facilities and laboratory materials(SD1 29/02/2020).

On the other hand, school principals explained their schools practice regarding the use of demonstration method as indicated below. Chemistry teachers in my school use teacher's laboratory demonstration rarely since there is high scarcity of some chemicals and apparatus in my school chemistry laboratory. Another cluster supervisor interviewed clarified their schools practice regarding the use of teacher's demonstration method for teaching chemistry practical parts saying:

The chemistry teachers in my school almost always use demonstration method whenever they go to laboratory for practical activities, since the laboratory room facilities such as space, working benches and seats are not convenient to allow students to conduct the activities themselves besides the shortage of some chemicals and lack of skill to use some apparatus. But, my school chemistry teachers using of the demonstration method itself is very limited for the reasons mentioned above (SS1 30/02/2020).

From this result one can conclude that most of the schools under study are not exploiting the numerous advantages of demonstration method as mentioned by different scholars. For instance, (Pavesic, 2008) suggested that the aim of demonstration is to provide students with a concrete example of good practice to copy adapt or learn technique. According to Pavesic, it is so vital for learning physical and intellectual skills: it shows how the task is carried out, what the task achieves, to what standard it should be carried out, the indicators that the task has been carried out successfully, and so on.

According to the data organized in table 7 item 5, 105(29.6%) students' and teachers responded the presence of a laboratory technician or assistant in their schools. About 233 (65.9%) confirmed the absence of lab technician/assistant in their schools. moreover, 16(4.5%) students reported as they don't know the presence or absence of laboratory technician/assistant in their schools. However, the computed means core 2.53 with SD 1.24

shows at level of disagreement that indicates absence of well trained lab technician/assistant. As I am informed during my laboratory observation, in schools, there is no lab technician simply teacher's replace lab technicians. In addition, in schools students and teachers were not available during the afternoon class for normal teaching and learning process as well as for practical activities.

Therefore, the absence of lab technician becomes one of the constraints of practical works in Adaba district secondary schools. That why the quality of chemistry education found at a lower standard and chemistry graduates lack some basic practical skills and experience and face difficulty to actually change the progress of their students towards chemistry practices. As (Kerr, 1963) identified that the most commonly mentioned factor for limiting the effectiveness of a practical activities is the absence of a trained laboratory assistant/lab technician.

Based on this information the above data in table 7, item 6 stated as follow. Different possible factors were listed in the students and teachers questionnaire to identify whether they are major constraints of practical activities or not. About 61 (17.3%) students and teachers admitted as lack of lab apparatus are one of the major constraints of practical works in chemistry. Inadequate laboratory apparatus hinder the practicality of laboratory session in secondary schools of Adaba district. Regarding lack of reagents 193(54.5%) students and teachers pointed out as one important constraint of practical activities in their schools. Those students and teachers who have taken lack of commitment and awareness of teachers, students and schools principals as one of the constraints of practical activities in secondary schools figure out as 57(16.1%).Large class size is considered as one of the constraints of practical activities and suggested by 43(12.1%) students and teachers. These students suggested that some schools have range of 60-70 students per class. This is too large not only for practical activities but also difficult to teach the chemistry subject in the normal class. So this matters a lot to discourage the teachers for conducting chemistry practical activities.

In addition students suggested that other factors such as poor management of school principals, turnover of teachers, delay of purchasing lab tools and reagents, changing previously laboratory rooms into normal classes, etc as main constraints for low level of practical activities in Adaba district secondary schools.

However, other challenges of practical work in chemistry related to physical resources from open-ended question and interview for department heads and school managements are:

unsafe laboratory rooms to conduct practical activities, lack of laboratory equipment, chemicals, and personal protective safety equipment. Among the respondent replied, “Expired chemicals and contaminated equipment in the workplace of their laboratory unsafely stored for the long period of years, because of this chemistry teachers as well as students worry about themselves rather than conducting practical activities in the laboratory room.” Laboratory has been given a central and distinct role in science education to conduct practical activities in chemistry. However, the findings are indicating a lot of concern has been shown about the inadequacy of chemistry laboratory in Adaba district secondary schools.

A greater deal of work has been done in an effort to identify problem that are inherent in the teaching of chemistry in secondary schools. These factors influence the effective teaching of chemistry which in turn plays a vital role in the lives of the students as it affects their performance. These include: physical classroom and laboratory, instructional arrangement and school management (Johnson, 2011).

The physical classroom and laboratory indicated the presence of good ventilation, availability of good chalkboard, preparatory room, enough chairs and tables, charts and clean environment. The dissemination of information with to students through bulletin boards, posters, and charts, if well organized and accessible to students will enhance assimilation and performance in their academics. Finally, the school management or organization is another vital factor that may be considered before anticipating a good result. The school management’s responsibility now includes positioning of the school laboratory, school library and provision of essential services like water supply, light, counselor services and first aid services (Owoeye and Yara, 2011).

Based on this point students and teachers gave their responses and the data in table 7, item 7 analyzed as follow. When the data is generalized, 121(34.2%) of the total students and teachers agreed that computer/plasma TV can somehow replace the actual experiment and demonstration carried out in the laboratory or classroom, but around 212 (59.9%) of the students and teachers responded that experiments and demonstrations presented by the computer/plasma TV does not replace the actual practical activities that take place in the laboratory and classroom or in the field and 21(5.9%) students and teachers are undecided. Therefore in addition to watching the demonstration and experiments transmitted in the computer/plasma TV, teachers should be prepared and planned practical activities and

encourage students to involve in practical activities in the laboratory. This makes learning chemistry more interesting, reliable and conceptual.

The computed average mean score 2.5 with SD of 1.3 indicates at level of disagreement this means demonstration and experiments mediated by the computer/plasma TV substitute the practical activities actually performed by the students and teachers in the laboratory. Therefore from this analysis someone understands that practical works in those schools which use computer/plasma TV as a medium of instruction have different trends and experience to practical activities comparing to which do not use computer/plasma TV.

Based on the information collected from the interview of students, teachers, department heads and school principals there are some dedicated and professionally responsible teachers to participate students in the actual lab session. Whereas schools, there is no plasma TV, by default students participate in laboratory session actively by doing, touching, and sensing all activities happening in the lab or classroom with their teachers. Similarly, chemistry department heads and school principals interviewed from schools explained the status of Plasma-TV program service in their school saying: Plasma-TV program was not functioning in my school for the last two years. Thus, currently we have no the opportunity to use Plasma-TV simulation for the teaching-learning of chemistry practical activities.

In the same vein the chemistry department heads interviewed from the schools those have functional plasma-TV program did not deny their using it sometimes. Thus, plasma-TV simulations were in use for the teaching learning of practical activities of chemistry in few secondary schools only. In general, since the number of schools under study those have functional plasma-TV program as of the period of data collection for this study were very few in number it is obvious that most of them are not in a condition to use plasma-TV simulations for the teaching-learning of chemistry practical activities.

Based on this point, the data in table 7, item 8 interpreted as 133 (37.5%) students and teachers responded that science laboratory clubs are existing in their schools and some of the clubs are functional and members are participated and benefited from experiments and demonstrations they carry out. But, most clubs of science are non-functional and they are not working far from their establishment. Members complained that I was the member of either biology, chemistry or physics laboratory club, but no one lab activity is carried out throughout the academic year. So it is meaningless to be registered as member of science laboratory club unless otherwise the club actively functions and makes students to involve in

it. About 188(53.1%) students and teachers gave witness that no biology, chemistry and physics laboratory clubs in their schools. Number of students and teachers who have no information about the presence or absences of science laboratory clubs were 33(9.4%) students.

However, the averages mean score 2.49 with SD of 1.16 shows at the level of disagreement this means majority of respondents respond no science laboratory club in their school. Nowadays biology, chemistry and physics laboratory clubs are established in secondary schools and students can get ample time to conduct practical activities after the regular class with the supervision and guidance of the teacher who is a club coordinator. These students are beneficiary if the club is functional and the students involve in practical activities according to the schedule of the club. These students can demonstrate the experiments they did for other students during the normal class.

So, establishment of Biology, chemistry and physics laboratory clubs is unquestionable and paramount advantageous to students to get additional skill from science practical works which would be carried out in the extra time after the end of regular class or during break time or lunch time as appropriate as for teachers and students. From the written question, students responded that laboratory clubs were formed, but they did not carry out activities after registering member students during their spare time. So, from result we can conclude that laboratory club activities are poor and carry out insufficiently.

Table:-8 Analysis of teachers perception towards implementation of practical activities in the laboratory classes of chemistry.

	Description of item	N		N (%)	Mean	SD
1	To what extent do you agree on include laboratory/practical activities in the annual lesson plan?	20	Strongly disagree	7(35%)	2.45	1.39
			Disagree	7(35%)		
			Undecided	1(5%)		
			Agree	3(15%)		
			Strongly agree	2(10%)		
2	To what extent do you agree the contribution of your school chemistry laboratory activities in facilitating the teaching-learning process and supporting theories with practices?	20	Strongly disagree	-	4.55	.51
			Disagree	-		
			Undecided	-		
			Agree	9(45%)		
			Strongly agree	11(55%)		
3	To what extent you need the current and regular workshop about laboratory activities to inspire and conduct practical activities more efficiently?	20	It is not necessary	1(5%)	4.05	1.5
			It is somewhat good	5(25%)		
			It is average	-		
			I have sufficient skill no need	-		
			Very necessary	14(70%)		
4	To what extent do you agree on regularly scheduled period for chemistry laboratory session/ practical activities your school?	20	Strongly disagree	4(20%)	2.50	1.27
			Disagree	9(45%)		
			Undecided	2(10%)		
			Agree	3(15%)		
			Strongly agree	2(10%)		
5	How often do school principals and department heads monitor and evaluate the implementation of practical activities as planned by the curriculum parallel to teaching the theoretical aspect of chemistry?	20	No such tradition at all	10(50%)	2.05	1.39
			Yes it is once a year	5(25%)		
			It is rarely done	1(5%)		
			Yes it is semester based	2(10%)		
			Yes it quarterly based	2(10%)		
Valid N (list wise)		20				

Note: - * <3 = Disagree, 3 = somewhat agree, and>3 = Agree

Table 8 item 1 shows about the scheduling of practical activities in the annual lesson plan of chemistry subject. Based on the data given in the table above, 5(25%) teachers revealed that they identify and briefly list out laboratory activities and experiments so they include in the annual plan of the particular chemistry subject. Depending on this description and schedule they try to conduct laboratory activities in each semester of the academic year. About 1(5%) teachers undecided and 14(70%) teachers responded as they did not include in the annual plan of the lesson and no separate plan for chemistry practical activities.

As interview confirmed, in such schools no follow up and monitoring system by school principals, department heads and other concerned bodies about chemistry practical works. Teachers carry out lab session as they want and/or question comes from students or parents. So, this should be corrected and teachers must include lab activities and selected experiments

either in the annual plan of chemistry lessons or it is better to prepare a separate program for practical activities that a teacher performs in the academic year.

Statistical analysis of average mean score for annual plan of practical activities shows that 2.45 with SD 1.39 of indicates at level of disagreement so majority of teachers didn't prepare annual plan for practical activities. In some schools teachers identify experiments and activities from the text book and include in the annual plan of the lesson, others they do not prepare plans/schedules at all and other teachers prepared separate plans consist of lists of experiments and activities to be done in each semester of the academic year. This is significantly a remarking factor in the awareness and responsibility of teachers to perform lab activities and encouraging students actively involved in practical activities.

Table 8 item 2 describes the relationship between chemistry teaching and practical activities. The data in the table shows that 11(55%)chemistry teachers strongly agree that chemistry teaching should be supported by practical activities for better understanding of students and to progress their academic results and to gain sufficient skills. In addition 9(45%) chemistry teachers responded as they agree that theoretical knowledge of chemistry should support with experiments and demonstration that would be conducted in the laboratory by direct involvement of students through the guidance and facilitation of teachers. As the data shows no one is disagreed the idea that chemistry learning should support and supplement by practical activities.

So, it is clearly indicated that 100% of the teachers agreed and they reach in one consensus that learning and teaching chemistry in secondary schools must be supported by real and frequent practical activities for fruitful and improvement of students' scientific skills and chemistry results. In addition, the calculated average mean score 4.55 with SD .51 shows at level of agree this indicate teaching learning chemistry supporting with practices. From this we can conclude that teachers have the same opinion to chemistry teaching must be supported with practical activities.

The data in table 8, item 3 above indicates that most teachers 14(70%) expressed they need regular workshops and seminars about techniques and procedures how to conduct practical activities. This is necessary for chemistry teachers to inspire and upgrade their laboratory skills and opportunities of students' involvement in laboratory activities increased. About 5 (25%) teachers responded that regular workshops and training about practical activities are

somewhat good to inspire teachers to apply practical activities according to the curriculum and the action plan of the school. But besides to this point, laboratory equipments and facilities should fulfill for successful implementation of practical activities in chemistry subject. No one responded as they have sufficient skills about laboratory activities and they did not need training and workshops about practical works in chemistry. Only one teacher (5%) respond that laboratory training and work shop for chemistry teachers is meaningless and not necessary.

This is because in some school totally no laboratory facilities. So, before giving training and workshop for teachers, school laboratory should be organized, fulfill lab tools and reagents and then teachers training come later on. Furthermore the teacher said that under such scenario, "discussing teachers training and updating practical skills and experience is meaningless and not necessary for me." So, it is better to give emphasis and prioritize the needs, problems and doing it one after the other must be the concern for school principals.

The calculated average mean result 4.05 with SD of 1.5 shows level of agree, teachers in the need of workshop, seminars and laboratory training of teachers about practical activities on a regular time interval. It might be appropriate at the end of the academic year to refresh and update the practical skill of teachers for conducting more additional experiments and activities and this also helps the students to actively engage in the chemistry practical activities in a better way. Laboratory training for chemistry teachers is very necessary to promote the implementation of laboratory works in all levels of a school.

During the interview, one of supervisor informed that repeatedly asked them to arrange experience sharing programs, there was no interest on the part of teachers to participate in lab training. One of the cluster supervisor replied that:

"The experience sharing programs do not facilitated by principals but teachers simply asked about their payment and benefits that they obtained. In addition, teachers in secondary schools are not interested to share their experiences even those high service holders but school principals and vice principals always visit them in the classroom and sometimes request feedback while as others do not like to give and receive their experiences." (SS2 30/02/2020).

Training (professional development) of teachers means helping teachers grow and develop in their understanding of teaching and learning process and improving their teaching skill. Professional development program for teachers should not be something imposed by outsiders. The finding of the current study was consistent with the previous research finding of (Speck and Knipe, 2001) in that teachers are often unhappy about professional

development that is imposed on them from the top. Because teachers are recipients of their professional learning, they should have a great deal of input and ownership in terms of planning, development and implementation of staff development program.

Table 8, item 4 above contains data about the schedule of practical activities in Adaba district secondary schools. About 5(25%) teachers responded agree as they prepare regular schedule and program every year for laboratory session according to the curriculum and the annual plan of the school. Whereas, 13(65%) teachers respond disagree as they did not prepare a regular schedule for laboratory sessions .So, they carry out practical activities without schedule randomly in their interest and the request of students. But, preparing a schedule which is matched with the annual plan of the chemistry lesson and the school is a mandatory and the ethics of the profession. Around 2 (10%) of teachers respond undecided.

Statistical analyses of average mean score 2.5 with SD of 1.27 shows that at level of disagreement so, majority of respondents are not prepare a regular schedule for laboratory. This study approved that teachers in some schools prepare laboratory programs separately or with the annual plan of the chemistry subject they teach based on the experiments and activities listed in the text book, but teachers in other schools did not prepare schedule for laboratory sessions and any supervision and follow up from school principals or department heads. So, the absence of a regular schedule for lab can affect the implementation of practical activities.

In secondary schools, the performance of practical activities should be co-ordinate by school principals and department heads. There should be a tradition and system to monitor and evaluate the activities of laboratory activities carried in chemistry departments on a given frame of time. Therefore, to justify this concept the data in the table 8, item 5 given above is briefly stated as follow. About 2 (10%) of the teachers confirmed that practical activities have been evaluated every quarter. Again 2 (10%) teachers respond that the implementation of practical activities monitored and evaluated once every semester in the academic year. 5(25%) teachers informed that monitoring and evaluation of practical activities takes place once a year.

Moreover, 1 (5%) teacher justified that monitoring and evaluation of chemistry practical works takes place rarely or it is very seldom. Those teachers who reported as there is no such secular and scheduler monitoring and evaluation systems are figured out as 10(50%). So, in this regard there is poor co-ordination and management of the school principals and

department heads of chemistry subject. This poor management and loose co-ordination among school principals, department heads and teachers was taken as one major constraint of poor laboratory activities in Adaba district secondary schools. Monitoring and evaluation are the backbone of all organization to identify strong and weak points and to get feedback from subordinates and to find solutions for problems and help to minimize weak points as well as to increase strong sides on a sustainable condition. Schools should establish a system on monitoring and evaluation for different activities and especially a system or tradition to evaluate the implementation of chemistry practical activities in schools at different levels. In this regard there are disparities & variation among Adaba district secondary schools in the systems and ways of monitoring and evaluation of practical activities.

Furthermore, statistical analysis of average mean result, 2.05 with SD of 1.39 shows that at level disagreement in monitoring and evaluation of practical activities in Adaba district secondary schools. From the interpretation of the statistical analysis someone can visualize that school principals and department heads monitor and evaluate the implementation of practical activities based on a variety of time frame and in some cases no system/tradition of monitoring and evaluation at all.

Table 9: Independent sample t-test of mean differences of teachers' and students' responses towards practice, attitudes and challenges on implementing of practical activities.

	Description of items	Respondents	N	Mean	SD	Mean difference	T – value	Sig (2-tailed)
1	On organization of chemistry laboratory.	Teachers	20	2.5	1.57	0.2	0.771	0.441
		Students	334	2.7	1.06			
2	On functionality of chemistry laboratory.	Teachers	20	2.2	1.24	0.43	1.733	0.084
		Students	334	2.63	1.16			
3	Scheduled demonstration of practical activities.	Teachers	20	2.49	1.26	0.01	0.033	0.973
		Students	334	2.5	1.30			
4	Presence of adequate facilities.	Teachers	20	2.3	1.41	0.04	0.152	0.88
		Students	334	2.34	1.12			
5	Skill, experience and perception towards practical activities chemistry.	Teachers	20	2.45	1.46	0.06	0.251	0.802
		Students	334	2.51	1.007			
6	Practical activities should carry a certain amount of total mark.	Teachers	20	2.25	1.33	0.49	1.774	0.077
		Students	334	2.74	1.19			
7	Presence/absence of lab technician	Teachers	20	2.38	1.23	0.11	0.411	0.682
		Students	334	2.49	1.16			
8	Factors affect the performance of practical work	Teachers	20	2.4	1.39	0.15	-0.73	0.466
		Students	334	2.25	.855			

Note: - * <3 = Disagree, 3 = somewhat agree, and>3 = Agree

From above table 9 item, 1 the mean of teachers on presence of well organized chemistry laboratory for implementation of practical activities score is 2.5 with 1.57 standard deviation and the mean of students score is 2.7 with standard deviation is 1.09. The mean difference between the two groups is 0.2 which is not powerful to show the significance of difference. The value for significant level is equal to 0.44 at the .05 alpha levels. It shows that there is no significant difference score for teachers and students based on the presence of well organized chemistry laboratory. The calculated T-test result also shows that there is no statistical significant difference between teachers and students respondents (at T-value 0.771; $p>0.05$). Therefore it is possible to deduce that, there might be presence of common ideas and information between teachers and students there were lack of well organized chemistry laboratory.

Generally, the respondents from the six secondary Schools have showed a practice of implementing practical activities is not that much good due to the absence of well organized chemistry laboratory. This is assured by the lower value of the total mean compared with that of the expected mean.

Table 9 item 2 above shows the numbers of teachers participants were 20 and students participants also 334. Mean of functionality of chemistry laboratory score for teacher is 2.2 their standard deviation is 1.24 and students score 2.63with standard deviation of 1.24.The mean difference between the two groups is 0.43 which is not powerful to show the significance of difference. The calculated T-value indicated that there is no statistically significance difference between the respondents based on functionality of chemistry laboratory (at T value 1.73; $p>0.05$). Therefore it is possible to deduce that, there might be presence of common ideas and opinion between the two groups about the theoretical knowledge of chemistry is not supported by practical activities in their schools and this makes chemistry learning incomplete and students could not get practical skill and experience which is the core point in chemistry to determine their destination.

From table 9 item, 3 teachers have a mean value of 2.49 with standard deviation of 1.26 and the mean of students is 2.5 with standard deviation of 1.3. The mean difference between the two groups is 0.01 which is not powerful to show the significance of difference. The calculated T-test result also shows that there is no statistical significance difference between teachers and students respondents (at T-value 0.033; $p>0.05$). Therefore it is possible to

deduce that, there might be presence of common ideas and information between teachers and students about the demonstration of practical activities.

Table 9 item, 4 shows lack of adequate facilities to conduct practical activities in the schools laboratory. The mean score of teachers is 2.3 with 1.41 standard deviation. And the mean score of students is 2.34 and the standard deviation is 1.12. The mean difference between the two groups is 0.04 which is not powerful to show the significance of difference. When we come to the analysis of adequate facilities for implementation of practical activities based on teachers and students the statistical analysis has showed that there is no significance difference between the two groups. Because at the calculated T-value .152; $p>0.05$.

As table 9 item, 5 indicated teachers and student's skill, experience and perception towards implementation of practical activities chemistry. The value for significant level is equal to 0.802 at the .05 alpha levels. It shows that there is no significant difference of attitude and skill score for teachers and students. The mean difference between the two groups is 0.06 which is not powerful to show the significance of difference. The calculated T-test result also shows that there is no statistical significant difference between students and teachers respondents (at T-value .251; $p>0.05$). Therefore it is possible to deduce that, there might be presence of common ideas and information between teachers and students.

Table 9 item, 6 the mean score of teachers is 2.25 with 1.33 standard deviation. And the mean score of students is 2.74 and the standard deviation is 1.19. The mean difference between the two groups is 0.49 which is not powerful to show the significance of difference. When we come to the analysis of implementation of practical activities based on assessment strategy, the statistical analysis has showed that there is no significance difference between the two groups. Because at the calculated T-value 1.77; $p>0.05$.Generally implementation practical activities without an examination a serious neglect of practical work can occur.

Table 9 item, 7 indicates that the most commonly mentioned factor for limiting the effectiveness of a practical activities is the absence of a trained laboratory assistant/lab technician. In addition science teachers should know well the subject matter they teach and lab activities that are planned to be carried out by the students. This is assured by the high value of the total mean compared with that of the expected mean. The mean of teachers challenge score is 2.38 and standard deviation is 1.23. And the mean of students challenge score is 2.49 with standard deviation of 1.16. The mean difference between the two groups is 0.11 which is not powerful to show the significance of difference. The calculated T-value

indicated that there is no statistically significance difference between the respondents based on their responses (at T value .411; p>0.05). Therefore it is possible to deduce that, there might be presence of common ideas and opinion between the two groups about the absence of lab technician.

As table 9 item, 8 from general respondents from the selected secondary schools have showed as the challenges of implementing practical activities chemistry are very high. This is assured by the high value of the total mean compared with that of the expected mean. The mean of teachers challenge score is 2.4 and standard deviation is 1.39. And the mean of students who have degree challenge score is 2.25 with standard deviation of .855. The mean difference between the two groups is 0.15 which is not powerful to show the significance of difference. The calculated T-value indicated that there is no statistically significance difference between the respondents based on major challenges of implementation practical activities (at T value - 0.73; p>0.05). Therefore it is possible to deduce that, there might be presence of common ideas and opinion between the two groups about the challenges of practical activities chemistry.

4.3. Responses of Department Heads on Practice and Challenges of Practical Activities.

Table 10:-Check list filled by department heads from Adaba district secondary schools to know the influences of determinant factors on practical activities.

No	Determinant factors		Rating			
			S	NS	SL	Total
1	Time allotment for lab work	N (%)	2(33.3%)	3(50%)	1(16.7%)	6(100%)
2	Laboratory facilities	N (%)	1(16.7%)	3(50%)	2(33.3%)	6(100%)
3	Current supply of equipment	N (%)	1(16.7%)	4(66.6%)	1(16.7%)	6(100%)
4	Availability of trained lab technician/assistant	N (%)	-	4(66.6%)	2(33.3%)	6(100%)
5	Class size and number of students	N (%)	-	3(50%)	3(50%)	6(100%)
6	Chemistry teachers' interest & commitment to conduct lab	N (%)	1(16.7%)	2(33.3%)	3(50%)	6(100%)
7	Students' participation and interest to lab works.	N (%)	4(66.6%)	2(33.3%)	-	6(100%)
8	Support and encouragement offered by school principals	N (%)	1(16.7%)	4(66.6%)	1(16.7%)	6(100%)
9	Provision of laboratory Workshops, seminars and training to teachers	N (%)	-	4(66.6%)	2(33.3%)	6(100%)
10	Annual budget allocated for purchase of equipments, reagents and other resources.	N (%)	2(33.3%)	3(50%)	1(16.7%)	6(100%)
Total		N (%)	12(20%)	32(53.3%)	16(26.7%)	60(100%)

Note: S = Satisfactory, NS = Not Satisfactory, SL = Serious Limitation

Table 10 contains 10 items which are rated by Adaba district secondary schools department heads about their practices and challenges on practical activities which are stated as follow.

1. Time Allotment for Lab Work

About 2(33.3%) department heads confirmed that time allotment for practical activities is satisfactory and again the number of chemistry departments i.e. 3(50%) of them noticed that time allotment for laboratory activities are not satisfactory and practical works are not sufficiently implemented in schools in general. 1 (16.7%) of the department head revealed that time allotment for chemistry practical works has serious limitation and practical activities in general are poor and insufficient in several secondary schools. From this result 50% respondents not satisfactory on time allotment for lab work in Adaba district secondary schools. So, lacks of time allotment for practical activities in the laboratory were one of challenge implementation of practical work chemistry.

From interview and open ended questions of teachers said "the 40 minute time frame not to be enough for practical work." Furthermore, reduced security on setup apparatus/practical work is a challenge since there is no proper place to leave apparatus for activity that gives results after hours/day. And also encountered a challenge on time management as the time given does not accommodate every leaner to participate especially in situations where materials are limited, the time given does not give a free pace to make sure every learner takes part and fully understand. The other factor was distraction from the environment, especially where the activity is conducted outside the classroom. To further add on to that, there were disturbances from the management as the management can call you on the mid of the activity to attend a management meeting.

Supporting this (Zoldosova and Prokop, 2006) suggested that limited time highly affect the practical work. When the teacher's time is over, another teacher has to come in which in most cases forces teachers to stop without attaining required results or learners understanding the topic. Also, for the reason of not having a science laboratory teachers are forced to place their setup apparatus in an uncontrolled environment like a classroom. By so doing the apparatus is highly disturbed by learners who want to explore what is going on, which leads to disturbed if not false results.

According to the interview of school principals and cluster supervisors as they briefly stated that "the problem of time allotment has begun when the curriculum has been developed and did not allocate sufficient time for practical activities. School principals and department heads also elaborated that they also encouraged teachers and students to carry out practical activities during extra time outside the regular session i.e. after the end of regular class and/or

on the weekend such as Saturday. By doing in such a way it has some contribution to compensate the time limitation for practical activities and students would get some opportunities to involve in practical activities."

2. Laboratory Facilities

About 1 (16.7%) of the department head justified that laboratory facilities are satisfactory in their schools. During my laboratory class observation I checked that more or less laboratory equipments, reagents and seating chairs, are fulfilled and well furnished in their schools. Therefore, some of the schools have the capacity to implement practical activities more efficiently than the others. On the other hand 3 (50%) of the department heads confirmed that laboratory facilities in their schools are not satisfactory and they create some problems to implement practical activities more effectively and efficiently as teachers and students require. The rest of department heads i.e. 2(33.3%) of them rated that there are serious limitations regarding practical activities in their schools and these limitations require a co-ordinate effort to minimize their shortage and to facilitate the implementation of chemistry practical works. From this we can conclude lacks of laboratory facilities are major challenges to implement practical work chemistry in secondary schools of sampled area.

However, they were indicating that lack of laboratory facilities for practical activities in chemistry related to physical resources through open-ended question and interview for teachers and school principals are: "unsafe laboratory rooms to conduct practical activities, lack of laboratory equipment, chemicals, and personal protective safety equipment and lack of policy and regulation of waste management." Laboratory has been given a central and distinct role in science education to conduct practical activities in chemistry. However, the findings are indicating a lot of concern has been shown about the inadequacy of chemistry laboratory in Adaba district secondary schools.

The practical experience also contributes an integral part of chemistry science, the subject consist of many topics that can be verified experimentally with an objective to create an stimulating and engaging environment to stimulate student learning about chemistry that is commonly presumed as abstract, quantitative, and boring. The availability of laboratory equipment's, chemicals and materials, laboratory assistant, working conditions in the laboratory and safety measures, substantial recommended textbooks and accurate periods allocated for the teaching of the subjects are studied and carefully controlled, then effective teaching of chemistry could be achieved, which will in turn created a scholastically rich,

rewarding environment (atmosphere) for the students to learn the basic tools of science (Frank and Saxe,2012).

3. Current Supply/Availability of Equipments

About 1 (16.7%) of chemistry department heads assured that the current supply/availability of lab equipments are satisfactory to implement chemistry practical activities in the laboratory. Around 4(66.6%) of department heads confirmed that their schools face some problems with the current supply/availability of laboratory equipments in their schools. So, based on this information schools above average are not satisfactory with the availability of lab equipments and practical activities take place partially. On the other hand, 1(16.7%) of chemistry department head revealed that some schools have serious limitation concerning the availability/supply of laboratory equipments and practical activities are highly influenced and undergoing insufficiently or totally non-functional. The results showed that the Practical activities in chemistry of secondary schools in Adaba district are being scared by lack of equipments.

From the result of open ended and interview questions of school principals and cluster supervisors responded as their schools have scarcity of basic lab equipments, reagents and other facilities for carrying out practical activities. To achieve the desired objective of effective teaching of chemistry in secondary schools, operational chemistry laboratory equipments has to be provided but it is dish-eating to note that most of our schools do not have functional laboratories. Supporting this (Tesfaye,2009) observed that infrastructure is often stressed as a result of the insufficient or incomplete laboratory equipments in most of the secondary schools both in the urban and the rural areas. With inadequate laboratory infrastructures, the students will be taken into the existing dilapidated existing one if any. Effective science teaching is the gateway to attainment of scientific and technological greatness and this can be achieved via integrating theory with practical work.

4. Availability of Trained Lab Technician/Assistant

About 6 (100%) of the department heads responded that lab technicians or assistants are not assigned in their schools and regarding this issue it is a serious limitation for practical activities to be implemented by teachers as well as by students according to the schedule or plan of the school. In some schools and departments, chemistry teachers are overloaded and they would be exhausted to support students to perform practical activities in the laboratory.

This shows that absence of lab technician in school were major challenge to implementing practical work chemistry.

Regards practical work as one of the most challenging tasks for chemistry teachers, for that reason it is practiced rarely or incompetently in many chemistry classrooms in the study area. According to (Reid, 2007) the various reasons suggested for teachers' opposition in adopting practical work include the absence of trained laboratory assistants.

5. Class Size and Number of Students

About 3 (50%) of the department heads revealed that number of students per class is still relatively larger comparing to the small size of the laboratory class and teacher was forced to demonstrate the experiments by doing themselves instead of encouraging students to perform each activity or experiment by themselves or alternatively, teachers try to divide a class of students into two halves and doing the experiments using shifts one after the others. This consumes time of the teacher and the students and it also affects the regular period to cover the lessons content according to the annual plan. Because of this teachers leave practical activities and they rush to cover the theoretical part of the lessons. Other department heads 3 (50%) of the total respondents recognized and underlined that class size are surprisingly too large and class management is so difficult even to give discussion and lecture in the normal teaching-learning hours. So, it is very challenging to implement practical activities using a large number of students per class. Large class size becomes a serious limitation for several secondary schools Adaba district to conduct practical works such as experiments and demonstrations of chemistry subject adequately.

The interview and open ended questions result from school principals and cluster supervisors agreed with idea of department heads that faced with large class sizes seemed to be in a situation where they handled more than 50 students in a class. This could partly explain the difficulty of employing practical work properly to reach every student in the class. Large class sizes mean this has to be managed very carefully. Possibly one way would be for the class of say 70 to be split into 10 groups of 7.In each group, one pair would carry out the practical, watched by the others. The others might evaluate the skills of the pair, using previously agreed criteria. Over time all students would do some practical work.

In line this (Tesfaye,2009) explained in his thesis, normally, it is assumed that number of students per class should be limited and manageable by the teacher in order to follow and

check up every activity that the teacher teaches and disseminates to the students. This becomes more essential for science teaching and to carry out practical activities as planned by the teacher when the number of students per class is manageable. So, to make effective demonstration in the class and carrying out experiments in the laboratory the students must be grouped in small number and the chance of each student to involve in the practical activity will be high and the students will gain more exposure and experience sharing. On the other hand, as the number of students increases the opportunity of each student to participate in the group becomes low.

6. Teachers' Interest and Commitment for Practical Activities

It is too difficult to know the interest, opinion and attitude of a person towards specific activities, but to get some idea about the general assumption and feelings of teachers towards teaching chemistry and their initiative and passion to conduct practical activities stated as follow using the data collected from department heads of chemistry teachers in Adaba district secondary schools. About 1(16.7%) of the department head reported that chemistry teachers interest and commitments for laboratory activities are satisfactory. While 2 (33.3%) of the department heads proved that teachers interest, feelings and commitments are not satisfactory for implementing practical activities and they have few initiative to encourage students in practical activities. The remaining 3 (50%) of department heads informed that teachers' interest and commitments are serious limitation for implementing practical activities in their schools. From this we can conclude teacher's interest and commitment for practical activities are one of constraint to implementing practical work in Adaba district secondary schools.

Moreover, the school principals and cluster supervisor replied through open-ended and interview results showed that the practical works in chemistry of secondary schools in Adaba district are being scared by the measurements involved, lack of motivation for teachers, low commitment of teachers for the practical classes, absenteeism of teachers from practical class, teachers poor knowledge about practical works and teachers skill gap towards practical work. This finding consistent with (Kerry, 1963) explained that some of the major factors that hinder the implementation of practical activities include; negative perception of teachers towards the practices of laboratory, lack of adequate budget, absence of smooth relationship between teachers and principals for the improvement of instruction, shortage of time on the part of laboratory to support all students in instructional process and un able to get support from education office to update their profession.

7. Students' Interest and Participation to Practical Activities

Most department heads 4(66.6%) argued that students have more interest to show their participation in chemistry practical activities. They are ready and more motivated to conduct practical activities/experiments to relate their theoretical knowledge they learned in the classroom. The department heads further elaborated that if students get encouragement from their teachers they are ready and ready to do experiments and demonstrate to their classmates.

On the other hand, 2(33.3%) of department heads reported as students' interest and participation are not satisfactory in their schools. Based on this point they proposed that these students need encouragement, motivation and continuous follow up to actively participate in chemistry practical activities. Generally students' interest towards practical activities is not a serious limitation in chemistry laboratory activities of Adaba district secondary schools. If lab facilities are sufficiently available and students get more support from their teachers and conditions for practical activities are comfortable they can actively involve for performing experiments and they are able to demonstrate and present what they have observed in the laboratory for other students.

Chemistry teachers were requested to respond the extent of their student's attitude towards practical activities in chemistry. The attitude of students towards practical work is medium and low respectively. The teachers and school managements were also requested through open-ended question and interview their student's low attitude towards practical work also replied that "Students' population is larger than the available apparatus during practical class; the working environment is unsafe to conduct practical activities and language difficulty to understand and interpret practical activities in their textbook."

The result supported with (SCORE,2007) the importance of practical work in science is widely accepted and it is acknowledged that good practical work promotes the engagement and interest of students as well as developing a range of skills, science knowledge, and conceptual understanding. In relation to this (Hodson,2001), states that if the goals and objectives are not expressed in terms of being able to apply scientific knowledge, understanding and skills there is a danger of students simply following recipes' during practical activities. This way of doing laboratory work or practical work has been criticized for its distortion of what science really is, encouragement of rote learning rather than meaningful inquiry-oriented learning and failure to provide students with opportunities to

plan investigations and perform their own experiments, manipulate equipment and materials so that they can construct their own knowledge of phenomena and related scientific concepts.

8. Support and Encouragement of School Principals

According to the responses of 1(16.7%) department head, they argued that support and encouragement of school principals for chemistry teachers and students is satisfactory and practical activities carried out more or less in a better way. While about 4 (66.6%) of the department heads responded that support and encouragement of school principals is not satisfactory and because of this there are limited and insufficient practical activities in secondary schools. The rest of the department head around 1 (16.7%) of them informed that because of ignorance and no support as well as encouragement from school principals there is serious limitation in practical activities of some schools.

Based on the interview of teachers and written responses of students, it is clearly explained that laboratory activities in Wosha, Lajo and Gededo which are seriously limited because of low concern and no support from school principals or owners of the school. So, the feedback from this research paper is necessary for such schools to bring a change in attitude and awareness to support and encourage teachers and students to participate as much as possible with the available resources in the school laboratories and the teaching learning process in chemistry should be supplemented with practical activities.

This poor management and loose co-ordination among school principals, department heads and teachers was taken as one major constraint of poor laboratory activities in Adaba district secondary schools. Monitoring and evaluation are the backbone of all organization to identify strong and weak points and to get feedback from subordinates and to find solutions for problems and help to minimize weak points as well as to increase strong sides on a sustainable condition. Schools should establish a system on monitoring and evaluation for different activities and especially a system or tradition to evaluate the implementation of chemistry practical activities in schools at different levels. In this regard there are disparities & variation among Adaba secondary schools in the systems and ways of monitoring and evaluation of practical activities.

9. Provision of Workshops, Seminars and Training to Teachers

From the responded department heads 4(66.6%) of them reported that workshops, seminars and training of practical activities giving to chemistry teachers are not satisfactory and it

contributes some impacts for poor and insufficient implementation of practical works in their schools. So, school principals, concerned educational bodies, parents and the community should participate to raise fund and to give laboratory workshops and seminars for chemistry teachers to empower and build their capacity for successful implementation of practical activities accompanying with their students. The remains of the department heads 2 (33.3%) of them confirmed that no workshops, seminars and training for teachers regarding practical activities and they explained that these conditions are serious problems and limitation of chemistry practical works. Especially the problems are highly magnified in most rural area secondary schools.

The researcher also found the same result through interview and open ended from teachers and cluster supervisor items thus, both group of respondents confirmed that teachers were unable to seen practical teaching is serving as a teaching strategy, the wait only school principals to do and giving immediate feedback, fear of chemical hazards due to safety issues in lab, understanding of students and teachers on concepts of practical activities every low and teachers seen like additional work on lab program.

(Adefunke, 2008) also stated that whatever the profession, there is need for training to create awareness of the problems of that profession. He stressed that such training, would improve the level of competence for dealing with such problems. This means that schools with stable, experienced and qualified teachers usually have better school facilities in terms of textbooks, equipments and the laboratories than that school which have difficulty in attracting experienced and qualified staff. He further said that attendance at chemistry workshop is expected to enhance the understanding of the teachers as to the facilities which are necessary for students' achievement in chemistry.

In-service on the job education create form for further learning which expose the workers to new development and ideas in their area of study. It could also be refreshing courses which make the professional not to lose grips with their skills, attitude or knowledge. In some cases, the reward for such training is promoting to a new rank or the acquisition of better and higher status in essence of this view, absent of this training affect the teachers in delivery of its duties effectively and paying teachers' enhanced salary to take care of their socio-economic needs to avoid divided attention in their duty.

10. Annual Budget Allocation

Regarding the allocation of annual budget for purchasing laboratory tools, reagents and other facilities responses of department heads stated as follow. About 2 (33.3%) of the department heads proved that budget allocation for fulfilling laboratory facilities is satisfactory. From my laboratory observation, organization and availability of laboratory facilities are good and sufficient. In the above mentioned schools the current status of laboratory facilities and implementation of practical activities are satisfactory except empowering and initiating teachers to use the resources and participate students to carry out practical activities frequently. Others department heads 3 (50%) of them reported that annual budget allocation for purchasing lab equipments, reagents and other facilities is not satisfactory and practical activities are carried insufficiently. Laboratories lack some important materials and reagents for implementing practical activities and showing students experiments and demonstration become impossible. The rest of the department head 1 (16.7%) of them stressed and addressed that budget allotment for laboratory facilities is almost none and it faces serious limitation for most secondary schools.

For some years, no purchasing of lab tools, reagents and other facilities because of not allocating annual budget for laboratory works. This is because of ignoring the contribution of practical activities and lack of awareness as well as concern to the functioning of laboratories in their schools. In some schools what is needed is to show simply the presence of non-functional laboratory classrooms with different materials and reagents. The presence of a laboratory is aimed with getting/renewal of license, since it is one of the standards by showing the room and the contents in it, but students don't actually involve conducting practical works in order to acquire skills of chemistry by approving the theory with practices done in the laboratory.

So, school principals reaffirmed that budget for the laboratory is scarce in general, and this shortage of finance is also aggravated because of the increment of the cost of laboratory tools, reagents and other facilities at the present time. Therefore, no sufficient money to purchase and fulfill the materials as it is required and this has its own impacts on practical activities in addition to other constraints.

4.4. Chemistry Laboratory Observation Check List

Table 11: - Summary of Chemistry Laboratory Observation

No	Name of school		Availability						Functionality of the lab		Conditions of lab tools & reagents		
			Chemistry lab room		Regular lab schedule		Lab technician						
			Se	C	P	A	P	A	FN	NFN	S	NS	NF
1	Adaba secondary		✓	-	✓	-	-	✓	✓	-	✓	-	-
2	Adaba preparatory and secondary		✓	-	✓	-	-	✓	✓	-	-	✓	-
3	Wosha secondary		-	✓	-	✓	-	✓	-	✓	-	-	✓
4	Haqo secondary		-	✓	-	✓	-	✓	-	✓	-	✓	
5	Gededo secondary		-	✓	-	✓	-	✓	-	✓	-	-	✓
6	Lajo secondary		-	✓	-	✓	-	✓	-	✓	-	-	✓
Total		**N**	**2**	**4**	**2**	**4**	**-**	**6**	**2**	**4**	**1**	**2**	**3**
		%	**33%**	**66%**	**33%**	**66%**		**100%**	**33%**	**66%**	**16.7%**	**33%**	**50%**

Note: - Se= Separate, Present, FN = Functional, C= Combined, A = Absent, NFN = Non Functional, S = Satisfactory, NS = Not Satisfactory, NF = Not Found

From my overall observation of the six (6) secondary sample schools, I try to identify the presence or absence of separate laboratory classes for chemistry subject. In addition through document analysis I try to examine the schedule, recording system of practical activities carried out by the teachers and students, monitoring and evaluation of each school. The presence or absence of laboratory technicians, whether the school laboratory functions or not and the materials and equipments found in the school and their status and present conditions of the tools have been checked and examined.

Based on the above table 11, from six (6) schools regarding the presence of a separate laboratory room for chemistry practical works, 2 (33.3%) of the selected sample schools have a separate lab room for chemistry subject to perform practical activities, whereas, 4 (66.6%) have a combined laboratory room to carry out the three subjects of natural science. As respondents confirmed the previous separated rooms in the school have been changed into normal classes for teaching-learning process. The combined rooms because the construction of the building has not been completed. As the school principal explained after the completion of the building the school will have a separate laboratory room for each field of natural science. In these four schools there was lack of separate lab to conduct chemistry practical activities.

The second point that assessed through laboratory observation and document analysis is the schedule for laboratory session. According to this examination, 2 (33.3%) of the schools have prepared a regular annual schedule for implementation of practical activities, on the other

hand as document analysis proved that 4 (66.6%) of the schools didn't have regular schedule for practical activities. Most schools don't have annual regular schedule for practical activities means that there is less monitoring, follow up and concern for implementation of chemistry practical activities. But this trend should be changed and department heads, school principals and other subordinate bodies interact and encourage schools and chemistry teachers for preparation of annual regular program for practical activities to improve and accelerate the present laboratory activities.

The third point that I carefully examined is the assignment of laboratory technicians or trained lab assistants. According to my laboratory observation in each sample school the data that indicates in general have no an assigned lab technician in their schools. In short, 6 (100%) of the secondary schools, don't have lab technician/assistant and this becomes one of the determinant factors for low standard of practical activities in Adaba district secondary schools.

The fourth point, I try to summarize in my laboratory observation and document analysis is that the current working or functioning of the laboratories for chemistry practical activities. Based on the data in table 11, has shown that 2(33.3%) of the sample schools are more or less functional, teachers and students are involved to carry out some experiments and demonstration in their school laboratories. Whereas, 4 (66.6%) of the sample secondary schools have poor standard and almost they are non functional. In these schools, students have no opportunities to participate and carry out experiments in the laboratory.

Lastly; conditions of laboratory tools and reagents are carefully observed and I arrived on the following data for description. The data regarding the current practice of equipments and reagents in secondary school laboratories stated as 1 (16.7%) of the secondary school have lab equipments, reagents and other facilities and they are satisfactory to perform practical activities in these school unless otherwise other factors hinder the ongoing of practical activities . On the other hand, 2(33.3%) of the sample secondary schools have very few laboratory equipments and reagents and therefore the organization of the laboratory is not satisfactory. About 3 (50%) of the secondary schools have no most of the laboratory equipments and reagents to perform practical activities of chemistry subject. Because of scarcity of budget and under construction laboratory tools and reagents are not available adequately for realizing practical works in these schools.

CHAPTER FIVE

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

A mixed research design was employed to conduct this study. To gather data relevant to the issue to be researched, the researcher employed both quantitative and qualitative data gathering instruments. That is, closed ended and open ended questionnaire, document analysis and semi-structured interview were used as data collection instruments. Questionnaire was distributed and its results were tabulated and analyzed with the help of both descriptive and inferential statistical techniques. Pilot study was conducted to check the internal consistency of the items using cronbachs alpha. The size of population was 387. Of these, 356 students were selected as a sample of the study using simple random and purposive sampling technique which includes 20 teachers out this six of them are department heads, 6 principals and 3 vice principals and 2 cluster supervisors. Finally, quantitative and qualitative data were analyzed and discussed thematically.

The result of this study highly important for students, teachers, education office and policy makers which emphasized on the implementation of practical activities to improve teachers' and students instructional process. Based on the interpretations and analysis of the data, the following major findings were obtained:-

1. From the findings majority (70.1%) of students and teachers indicate that the practices of teaching chemistry practical activities in the laboratory classes in Adaba district secondary schools faced with many factors. This due to the fact that teachers un able to select and use laboratory work techniques, on knowing aim and importance of every laboratory activities, lack of student experiments and principals commitment . It is found that both quantitative and qualitative findings about the practice of practical activities indicate that there is no organized and relevant laboratory room, teaching learning were not supported with practical activities, lack of immediate and continuous feedback from concerned body and there is no separate time table, lesson plan for laboratory class, the imbalance of time budget between classroom teaching, laboratory practice, and practical fieldwork show drawbacks on implementation of practical work that were identified in this study. As a result, the status of practical activities practice is far from what is needed, and they concentrated on theory part. There is no timely and change oriented support for teachers from school principals and cluster supervisors.

According to (Hodson, 2013), students learn more from scientific lessons when they are given the opportunity to learn through doing the work themselves than when they are simply allowed to watch. (Hofstein, 2007) attributed that: “Laboratory activities appeal as a way to learn with understanding and, at the same time, engage in a process of constructing knowledge by doing science”. He therefore advocated that meaningful learning is possible in the laboratory if students are given opportunities to manipulate equipment and materials to be able to create their knowledge of phenomena and related scientific concepts. The student activities are most completely neglected and demonstration classes are held not according to schedule but according to how convenient it is for the teachers.

2. The result showed that majority (68.6 %) of students and teachers respond there is misconception on implementation of practical activities in the laboratory classes of chemistry. Thus, both teachers and students group respondents confirmed that they were unable to seen practical teaching is serving as a teaching strategy, the wait only school principals to do and giving immediate feedback, fear of chemical hazards due to safety issues in lab, understanding of students and teachers on concepts of practical activities very low and teachers seen like additional work on lab program. And also the dominant ideology and tradition on paper pencil examinations in schools assessment program made schools to forget and ignore the contribution of practical activities and not giving credit to chemistry achievement of students. According to the results of interview question with teachers, they responded that because of lack of awareness, material constraint and the like, there is no support from school administration. School principals and cluster supervisors also confirm what the teachers respond to the question. They reply that some times, only they try to give some awareness for teachers, which is not adequate.

The study also found that most secondary school students have a fair attitude towards chemistry and chemistry activities. This finding suggests that student’s attitudes to chemistry practicals are, generally speaking, positive. This study suggest that teachers need to be more aware that students attitude to chemistry practical’s is positive, rather than seeing the students attitudes as negative and unchanging. Teachers should consider the content being studied and create a more conducive classroom environment. (Sharpe, 2012) reported that, the classroom climate established by the teacher can have a major impact on learners motivation and attitude towards learning and ultimately to performance in the subject.

3. The finding showed that majority (72.95%) of students and teachers respond implementation of practical activities in the laboratory classes faced with many challenges. This result showed that with the exception of functional lab room, absence of separate lab rooms, practical activities not carry a certain amount of percentage from total mark, lack of manuals, inadequacy of laboratory equipments and reagents, safety materials, sufficient program coverage, lack of awareness, interest and commitment, absence of lab technician and materials are different factors hinder the implementation of practical in the Adaba district secondary schools. The missing link between theory and practices also found the same result using interview and open ended items about the implementation of practical work. The current study confirmed that schools are without basic equipments, reagents and other facilities and practical works in these schools are not carried out totally and the laboratories are dysfunction.

(Motswiri,2004) described practical chemistry as students ability to use manipulative skills, accurate and sharp use of five senses in a well coordinate manner and ability to apply the knowledge acquired to solve other problems. To achieve this, enough materials, science and technology learning environment must be provided to promote learners' skills and knowledge through rich and various characteristics.

4. In principle, most students, all chemistry teachers, school principals and cluster supervisors all together argued that chemistry practical work is very necessary and relevant and played a great role in supporting and facilitating chemistry teaching and learning process. Having this understanding in mind, no satisfactory implementation of practical activities in any of the sample schools as it is required to be.

5. Majority(84.7%) of students and teachers respondents respond that demonstration and experiments mediated by the plasma TV/computer is a one way communication and they agreed that it did not replace the actual practices that are carried out in the laboratory by full and active participation of students. But it has a very good contribution for those schools seriously suffer from lack of lab equipments, reagents, lab facilities and no well trained lab technicians or teachers for performing practical activities and in general their school laboratories which are totally non-functional in any way.

5.2. Conclusions

Based on the major findings of this current study, the following conclusions were drawn;

1. Using different practical work techniques is not adaptable in most teachers' activity. Almost all teachers use only theory parts to teach their students. Students cannot get a chance to show their performance through different techniques.
2. Though it seems that some teachers integrate practical activities in their lesson plan, there is a gap to implement what they plan in their lesson. Teachers prepare practical activities lesson plan because of that they asked by their department heads. The plans itself lack the procedures and different techniques by which practical activities practiced.
3. Most teachers have no training regarding practical work in their in service program. This makes teachers not to have the knowledge of practical work which makes them not to practice as intended. Though few teachers took the training, due to some other problems related to school factors (lack equipments and reagents, time constraint) they were not practiced it well. So, the practice of practical work in secondary schools of Adaba district is low.
4. There were no provision of practical work guidelines and ground rules in teaching learning activities to assess learners' theoretical concepts and practical skills. In the absence of guide line it is difficult to use practical work to teach students in meaningful way. In addition, lack of practical work guide line, makes the process of implementation not uniform in schools.
5. One of the most important for teachers' good performance is the support that made from school administration. As the study result shows, concerning practical work, support from school is not something which brought a change in the teachers' performance. Generally fulfilling the necessary school infrastructures, continuous follow up ,support, immediate feedback for the teachers and training opportunities are demands more emphasis in the secondary schools of Adaba district.
6. This study searched out that there are financial problems to re organize and fulfill the required facilities of laboratories in Adaba district secondary schools. This shortage in budget is responsible for poor and insufficient practical activities in secondary schools.

7. This study clearly identified the core challenges. The major constraints of practical activities are inadequacy of laboratory facilities, lack of trained lab technicians, and lack of proper attention given to practical activities by concerned stake holders.
8. The findings confirm that the use of chemistry practicals is an effective method in improving student's performance in chemistry in secondary schools. They also confirm that the nature, quality and frequency of chemistry practical are in teaching and learning of chemistry increase learner performance in chemistry. Use of chemistry practical's enhances students knowledge and understanding in a better way compared to none use of the chemistry practical's. While it is important to encourage use of chemistry practical's in the teaching and learning of chemistry, it is equally important to consider the nature, quality and frequency of the practical work.
9. The study showed that chemistry practical's increase student's interest and abilities in chemistry subjects as well as their achievement in chemistry. This is because chemistry practical classes help students in understanding theories and chemical principles which are difficult or abstract. Moreover, chemistry practical's offers several opportunities to students such as: developing scientific thinking and interest to chemistry, developing basic manipulative and problem solving skills, hands-on experience in using instruments and apparatus, and identifying chemical hazards and handling chemicals safely and other science process skills. To improve quality of chemistry practical's, it is important to consider reducing the number of learners in chemistry classrooms. This will imply that more chemistry teachers be employed, more classrooms and laboratories built and equipped. In terms of classroom routines, the activities and the exercises should be designed in a way that promotes making links between the practical and the theoretical. Enough time and attention should be dedicated to discussing and reflecting on the connections between the natural world and the ideas of chemistry.
10. Generally, from the view points of the investigation and the evidences assessed, it is possible to conclude that the status of use practical work chemistry in the Adaba district secondary schools practice were below the expected as a standard.
11. Finally, the investigation of the study searched out the following challenges as the main constraints and limiting conditions of the current practical works in secondary schools.
    a. Absence of separate lab rooms and small sized laboratory rooms for the accommodation of all students of a large class.
    b. Lack of laboratory facilities and lab technicians.

c. Lack of attention and concern given to the practical works by school principals and government.
d. Financial problem and shortage of time.
e. Poor monitoring, evaluation and supervision of practical activities by department heads, school principals and cluster supervisors.
f. Low commitment and interest of teachers either to conduct experiments and demonstrations or not volunteer to encourage students to involve in practical activities both in the regular period and during extra time.

5.3 Recommendations

Based on what this study has revealed the following recommendations have been provided for any attempts designed to bring about improvement and effective implementation of practical work at Adaba district secondary schools.

1. To implement more practical activities in the laboratory classes of chemistry in secondary schools it requires that chemistry teachers undergo intensive in-service training in practical activities management and latest research to improve their practices. Pre-service training of teachers should have significant practice in basic and higher order science process skills so that new teachers are more confident to use practical work when they teach chemistry and other sciences. Also, teacher training colleges should train teachers to use hands-tools so that they can improvise, where possible, science equipment for practical work. Training in the use of the kit, monitoring the implementation, continuous support to teachers and a steady system for acquiring spare parts are key factors in the successful implementation of the small scale chemistry approach in schools.
2. For chemistry practical's to result in a significant positive impact on a student's ability to learn both the desired practical skills and also the underlying theory, it is recommended that students be given an opportunity to engage in deep learning. Deep learning provides opportunities in identifying the main objectives of the work and in planning and executing it, of identifying the conceptual and practical difficulties encountered, recording and discussing the results and observations and of suggesting practical alterations and improvements.
3. It is also recommended that that there should be further inspection of the curriculum and learning standards for chemistry practical's in secondary school chemistry and an in-depth study of teacher competence in the teaching of practical chemistry is suggested.

4. Another recommendation is on the integration of information communication and technology (ICT) in the teaching and learning of chemistry. The computer and its Internet access have a lot of potential to improve science education. The integration will help to improve the quality of chemistry practical work, reduce problems of lack of enough laboratory facilities and equipment and other such factors that affect the effectiveness of chemistry practicals. The scope of information that is available over the web and in other ICT- based cognitive tools and also in virtual laboratories and simulations should be part of teaching and learning chemistry at all levels, in order to enrich the understandings of its concepts and theories in different contexts.
5. It would seem from the findings on teacher concerns in the study that sufficient attention is not being directed to teacher training in school level. For this to be realized, however it is recommended that continuous and ongoing staff and administrative development. So that practical work can be institutionalized and sustained .Indeed the ministry of education must support the professional development change requires. Providing clear and understandable manuals and guidelines for the front line practitioners of practical work for teachers, principals and supervisors is what the Ministry of Education and Regional Education Bureau should take the major role.
6. Practical and incentive training for both teacher and school management should be provided to change their knowledge, attitude and skills of practical activities. Materials are essential for the practice of the matter. There should be material (reference books, manuals, laboratory equipments and reagents, safety materials) provision to help the practice of practical work from the concerned body. As practical is an integral part of the subject. Then there should be well-equipped laboratories with essential facilities like water system, electricity and fire extinguisher, to mention but few.
7. Laboratory work task force should be formed to follow and supervise practical activities, to facilitate and prepare a forum in every semester concerning the strength and weakness of practical activities and to collect some mechanisms for practical work practices improvement. In addition to this, to facilitate experience sharing among departments and with other colleagues. This could be done by principals and cluster supervisors.
8. School administrator, and department heads should include the issue of practicing practical work in their plan and make a discussion and set an objective with teacher prior the starting of practice. School administrators and district educational experts expected to

give timely constructive support for teachers as well as for students to enhance the practice.

9. In case where the students outnumbered the available apparatus for a typical experiment, the teacher should apply grouping method of instruction to enhancing the motivation of students toward the practical work; the teachers should attend to their chemistry practical classes regularly and punctually; the school managements should understand the value of the practical work in chemistry and be willing to provide the time, location, facilities and staff resources for its implementation and should make provision for a separate laboratory room for chemistry and stock it with needed apparatus. The school management does not generally participate directly in practical works, but they might visit debriefing meetings, motivate and recognized a teacher who is a model for the staffs in practical work. It is also recommended that the government and concern bodies take a measurement to establish safe and secure chemical laboratory in schools; distribution of the equipment should be carefully planned and coordinated; the government on their part should recruit skilled chemistry teachers who could handle practical aspect of chemistry competently; workshops and seminars should be organized for the teachers and school managements on practical work chemistry to create common understanding and awareness.
10. Further research could be conducted specially on the comparison of practical activities practice and challenges between administrative town and rural district.

References

Abimbola, I. O. (1994). A critical appraisal of the role of laboratory chemistry practicals In Science teaching in Nigeria. *Journal of Curriculum and Instruction*, 4 (1&2), pp.59-65.

Abrahams, I. & Millar, R. *(2008).* Does a chemistry practical really work? A study of the Effectiveness of chemistry practical's as a teaching and learning method in School science. *International Journal of Science Education.* **30**.14: *1945-1969*.

Abrahams, I., & Reiss, M. (2012).Practical work: Its effectiveness in primary and Secondary schools in England. Journal of research in science teaching, 49(8), 1035-1055.

Adedayo and Julius O. (2015) Analysis of factors influencing students‟ attitudes towards The Practical aspect of secondary school physics in Ekiti state. International Journal of Multidisciplinary Research and Development, 2(7), 417-421, 2015.

Barton, R. (2004). *Teaching secondary science with ICT*. Berkshire, England: Open University Press.

Bekalo S. A. and Welford A.G. (1999), International Journal of Science Education VOL. 21, NO. 12

Bekalo S.A (1997), Factors influencing the place and development or Practical work in Secondary science, the case of Ethiopia, (Unpublished PhD Thesis)

Belay T. (2012)"Laboratory Activities and student's practical performance: The case of Practical organic chemistry in Haramaya University, Ethiopia ", International Journal of Education and management Engineering (IJEME), Vol.6, No.6 Pp.54-64, 2012.DOI: 10.58151 ijeme 2012.06.06.

Bennett, J. (2003). *Teaching and Learning Science.* London, England: The Continuum International Publishing Group Ltd.

Braukamper, (2002).Islamic history and culture in southern Ethiopia: collected Essays (Hamburg: Lit Verlag), pp.59-62

Cardak, O. (2007).Effect of the usage of laboratory method in primary school education For the achievement of the students learning. Turkey: selcuk University faculty Of education, Konya.

Carnduff, J. & Reid, N. (2003). *Enhancing undergraduate chemistry laboratories: Pre-Laboratory and post-laboratory exercises*. London: Royal Society of chemistry.

Chueng, D. (2007). Facilitating chemistry teachers to implement inquiry-based Laboratory Work. *International Journal of Science and Mathematics Education, 6*, 107-130.

Creswell, J. W. (2005). *Educational research: Planning, conducting, and Evaluating Quantitative and qualitative research (2nd ed.).* Columbus, OH: Pearson Merrill Prentice Hall.

Creswell, J.W. (2003). Research Design: Qualitative, Quantitative and Mixed Method Approaches. Second Edition. London: Sage Publications Inc.

Creswell, J.W. and Plano Clark, V.L. (2009). Designing and Conducting Mixed Methods Research. Thousand Oaks, CA: Sage. EETP

Dewey, J. (1938). *Experience and Education.* Toronto: Collier-McMillan Canada ltd.

Duckett S.B., Garratt J, and Lowe N.D., (1999), what do chemistry graduates think? *University Chemistry Education,* **3**, 1-7.

Duckworth, E. (1990). Science Education: A Minds-on Approach for the Elementary Years. Hillsdale, NJ: Lawrence Erlbaum.

EMA (2002), Methodology of Teaching Natural Science: Foundation for modern science teaching. Addis Ababa: Ministry of Education.

Ethiopian National Agency for UNESCO (2001), the Development of Education, National Report of Ethiopia, Addis Ababa.

Fensham (1992), Development and Dilemmas in Science Education.

FDRE, (2004). Federal Democratic Republic of Ethiopia. Report on the development Of education to the UNESCO forty- seventh session of International conference on education, 8-11 September 2004.Geneva, Switzerland.

Frank MC, Saxe R (2012). Teaching replication. Perspectives on Psychological Science, 7(6): 600-604. Francis LJ, Greer JE 2006. Measuring attitude towards science among secondary school students: The affecting domain. Research in Science and Technological Education, 17(2): 219-226.

Gee, S.G, (1992).School science rev.73 (265), 79-83

Goh, N. K., & Chia, L. S. (1988). *Improving chemistry laboratory work*: *Teaching And Learning.* Manila: Singapore Institute of Education.

Goldberg, L.R. (1992).The development of markers for the Big-Five factor Structure. Psychological Assessment, 4(1), 26-42. https://doi.org/10.1037/1040-3590.4.1.26

Gravoso, (2008).Design and use of instructional materials for student-centered learning:

A case in learning ecological concepts. The Asia-pacific education researcher.

Hodson, D. (1990). A critical look at chemistry practical zing school science. *School Science Review*, 70, 33-40.

Hodson, D. (2001). Chemistry practical's in science: Time for a reappraisal. *Studies In Science Education,* 19, 175-184.

Hofstein, A. (2004). The laboratory in chemistry education: Thirty years of experience With developments, implementation, and research. *Chemistry Education: Research and Practice, Vol. 5, No. 3, pp. 247-264*. Published Online.

Hofstein, A. & Lunetta, V. N. (2003). The laboratory in science education: Foundations For the twenty-first century. *Wiley Periodicals, Inc. Sci Ed* 88:28 – 54; Published Online in Wiley Inter Science (www.interscience.wiley.com).DOI 10.1002/sce.10106

Hofstein, A. & Mamlok-Naaman, R. (2007). The laboratory in science education: the state Of the art. *Chemistry Education Research and Practice, 8(2), 105-107*. The Royal Society of Chemistry.

Hofstein, A., & Walberg, J. (2005). *Instructional strategies.* International Educational Journal, Vol. 5 No 1 p. 26. Published online.

Hofstein, A., & Lunetta, V. N. (1982). The role of the laboratory in science teaching: Neglected aspects of research. *Review of Educational research,* Vol. 52, 2: pp.201-217.

Hunter C., Wardell S. and Wilkins H., (2000), Introducing first-year students to some skills Of investigation in laboratory work, *University Chemistry Education*, **4**, 12

Ikeobi, I. (2004). *Identification and teaching of different concepts in Chemistry*. STAN Bulletin, 11(2), 3 – 5.

Jenkins, E.W. (2003). Guide-lines for policy making in secondary school science and technology education. UK: Division of Secondary, Technical and Vocational Education Section for Science and Technology Education, UNESCO.

Jennings, K. (1998). Science in the locality. Cambridge: Cambridge University press.

Johnson L (2011). Teaching Outside the Box: How to Grab Your Students by Their Brains. Francisco: Jossey Bass.

Kerr J.K (1963), Practical work in school science, England and Wales, Leicester University press.

Kim, M., & Chin, C., (2011). Pre-service teachers' views on practical work with Inquiry Orientation in textbook oriented science classrooms. *International Journal of*

Environmental & Science Education, 6 (1), 23-37.

Kumar, R. (2005). *Research methodology*: a step by step guide for beginners. 2nd Edition, London, UK: Sage Publications Ltd.

Kumar, Ranjit (2011). *Research Methodology: a step-by-step guide for beginners*. 3rd Edition. New Delhi: SAGE Publications India Pvt Ltd.

Kothari, C.R. (2004). *Research methodology: Methods and Techniques*. 2nd Edition, New Delhi, India: New Age International Publishers.

Lakatos, I. (1970). Falsification and the methodology of scientific research programmers.

Lakatos, I. and Musgrave, A. (1997) (eds.), *Criticism and the Growth of Knowledge* (pp. 91-196). Cambridge: Cambridge University Press.

Lagowski, J. J. (2002) the role of the laboratory in chemical education. Retrieved from http://www.utexas.edu/research/chemed/lagowski/jjl_beijing_02.pdf

Lazarowitz, R. & Tamir, P. (1994). *Research on using laboratory instruction in science*. In D.L. Gabel (Ed.), Handbook of research on science teaching and learning (pp. 94–128). New York: Macmillan.

Ling, T. A., & Towndrow, P. A. (2010*). Giving students a voice in science practical Assessments.* Centre for Research in Pedagogy and Practice, Singapore: National Institute of Education.

LeMarechal and Tiberghie (2001). An analysis of Lab work task used in science teaching At upper secondary school and university levels in several European Countries. Science Education 85(5): 483-508.

Lunetta, V.N. (1998). *The school science laboratory: Historical perspectives and centers for Contemporary teaching*. In: B.J. Fraser & K.G. Tobin (Eds), International Handbook of science education. Dordrecht. Kluwer Academic Publishers.

Lunetta, V. N., Hofstein, A., & Clough, M. P. (2007). *Teaching and learning in the school Science laboratory*. An analysis of research, theory, and practice. In, S. K. Abell and N. G.

Madsen H.S. (1968, "The curriculum-ESLC seminar of 1967", Ethiopian Journal of Education Faculty of Haile Silassie-I University, Vol.2, No.1

Mathewos Anza, (2016)"Assessment of Factors Influencing Practical Work in Chemistry: A Case of Secondary Schools in Wolaita Zone, Ethiopia", International Journal Of Education and Management Engineering (IJEME), Vol.6, No.6, pp.53-63, 2016. DOI: 10.5815/ijeme.2016.06.06.

Millar, R. (2004). *The role of chemistry practical's in the teaching and learning of*

Science High school science laboratories: role and vision. Washington, DC: National Academy of Sciences.

Millar, R. (2001). *Teaching and learning science through chemistry practicals*.York: University of York Science Education Group.

Millar, R. (2010). Good practice in science teaching. In J. Osborne & D. J (Eds.), *Practical work*. Maidenhead: Open University Press.

Millar, R., Le Marèchal, J.-F., & Tiberghien, A. (1999). `Mapping` the domain: Varieties Of practical work. In J. Leach & A. Paulsen (Eds.), *Practical work in Science education Recent research studies* (pp. 33-59).Roskilde/Dordrecht: Roskilde University Press/Kluwer.

Miha L. (2006). *What does constructivism suggest for science education*? Issue Paper: California State University, Northridge.

Mittal, A. (2004). Teaching of chemistry. New Delhi: APH publishing Corporation.

Ministry of Education (2010). Chemistry grade 9-12 student text. Federal Democratic Republic of Ethiopia, Addis Ababa

MoE (1994). Education and training policy. Addis Ababa: Education materials Production and Distribution Agency.

MoE (2010). The education and training policy and its implementation. Addis Ababa: Ministry of Education, Ethiopia, 2010.

MoE (2010). Curriculum frame work for Ethiopian education, KG- grade 12.Addis Ababa; A.M Printing and packing plc.

Motswiri, M. (2004).Supporting chemistry teachers in implementing formative assessment Of investigative practical work in Botswana.Enschede: University of Twente.

Muijs, D. (2004). *Doing quantitative research in education with SPSS*. London: Sage Publications.

Mugenda, A.G. (2003).Research methods, quantitative and qualitative approaches. Nairobi, Kenya: Acts Press.

Nayak, A.K. and Rao, V.K. (2004). Classroom Teaching: Methods and Practices. New Delhi: APH Publishing Corporation.

Newman, D. (1982). Perspective-taking versus content in understanding lies. *Quarterly Newsletter of the Laboratory of Comparative Human Cognition,*4, 26- 9.

Newman, M.S. (1982). A beginning undergraduate organic laboratory course for the Serious student. *Journal of Chemical Education*, 59 (4), 387–388.

Nuffield Foundation (1966), Physics Teacher's Guide-I London, Longmans, Green & Co.Ltd.

Odubunmi, O., & Balogun, T.A. (1991). The effect of laboratory and lecture Teaching methods on cognitive achievement in integrated science. *Journal of Research in Science Teaching,* 28(3), 213–224.

Office for Standards in Education (Ofsted), (2005). *Science in Secondary Schools*. London: HMI/Ofsted. Available at: http://live.ofsted.gov.uk/publications/annualreport0405/4.2.15.html.

Ottander, C. & Grelsson, G. (2006). Laboratory work: the teachers‟ perspective. *Journal of Biological Education,* 40(3), 113–118.

Owoeye JS, Yara PO (2011). School facilities and academic achievement of secondary School agricultural science in Ekiti State, Nigeria. Asian Social Science, 7(7): 64-74.

Pavesic, B. J, (2008). Science achievement, gender differences, and experimental work in Federation of Teachers; 17(3) 28-35.

Pickering, A. (1992). Science as practice and culture: University of Chicago Press.

Reid, N. & Shah, I. (2007). The role of laboratory work in university chemistry. *Chemistry Education Research and Practice;* 8 (2), 172-185.

Salomon, G., Perkins, D., & Globerson, T. (1991). Partners in cognition: extending human Intelligence with intelligent technologies. *Educational Researcher;* 20(3), pp 2-9.

SCORE. (2007). *Practical work in science: a report and proposal for a strategic framework.* London: The Science Community Representing Education, (SCORE).Retrieved from http*://www.scoreeducation.org/media/3668/report.currentissues*.

Sharpe, R. M. (2012). Secondary school students‟ attitudes to chemistry practicals in School science. Unpublished PhD thesis. University of York.

Solomon Araya (2007), The contradiction between the Ethiopian government Rhetoric of new Education Policy and the reality of adaptation of earlier unsuccessful reform proposals". Journal of Education for Development,Vol- II, No.1

Solomon, J. (1987). Social influences on the construction of pupils understanding of science. *Studies in Science Education*, 14, 63-82.

Solomon, J. (1994). Teaching science, technology and society. Philadelphia: Oxford University Press.

Tamir, P. (1972). The practical mode a distinct mode of performance. *Journal of Biological Education, 6*, 175-182.

Tamir, P., Doran, R, L., & Chye, Y, O. (1992). Practical skills testing in science. *Studies in Educational Evaluation, 18*, 263-275.

Tekeste Negash (1990), The crisis of Ethiopian Education: some implication for national – building/Uppsala Sweden.

Tesfaye Abebe (2009), Status of Physics practical work implementation, the case of some selected government and private secondary schools in Addis Ababa city Administration, Addis Ababa, AAU

Tiberghien, A. and 16 others (1998). Science Teaching and Lab work Practices in Several European Countries (3 volumes). Orsay: University Paris-Sud XI. Ava at:http://www.physik.unibremen.de/physics.education/niedderer/project Lab work/papers.html.

Tsuma, R. (1997). Science education in Africa. Nairobi: Jomo Kenyatta Foundation.

Tobin, K.G, (1990). *Research on science laboratory activities*: In pursuit of better Questions and answers to improve learning. School Sci. Math. 90: 403-418.

Tobin, K. G. (ed.), (1993). *The practice of constructivism in Science and Mathematics Education.* Washington DC: AAAS press.

Tolosa Geleta, (2015)," *How can I improve my student's ability in doing laboratory? Practical work on chemistry*: A case on Kamise College of teacher's Education." International journal of education and management Engineering (IJEME) vol.6 No.6 pp.55.66, 2015.DOI: ISSN 2227- 5835.2015.06.06.

Twoli, N.W. (2006). *Teaching secondary school chemistry.* Nairobi, Kenya:Nehema Publishers.

Wellington, J. (1998). *Practical work in school science. Which way now*? London: Routledge.

World Bank (1999). Educational Change in Latin America and the Caribbean. Paper on Latin America and Caribbean Region. Human Development Department.

Woube Kassaye (2005), An Overview of Curriculum Development in Ethiopia: 1908-2005 Addis Ababa.

Yamane T. (1967).Statistics: An introductory analysis, 2nd edition, New York: Harper and Row. American Journal of Applied Mathematics and Statistics.2016, vol.4 No.6, 178-184 Dol: 10.12691/ajams-4-6-3.

Zoldosova and Prokop (2006), Education in the field influences children's ideas and Interest toward science. Journal of Science Education and Technology, 2006.

Appendices

Appendix I

Madda Walabu University

College of Education and Behavioral Studies Department of Curriculum and Teachers Professional Development Studies

Questionnaire to be filled by students

The purpose of this questionnaire is to collect information about the current practices and challenges of practical activities implementation at Adaba district. The information gathered through this questionnaire will be used only for the research purpose and you are confidently assured that your response will be held in strict confidentiality. Therefore you are kindly requested to fill the questionnaire genuinely and responsibly for it is the chief determinant to the success and truthiness of the study. The researcher would like to express his thanks to you in anticipation for devoting your time, experience and energy to complete this questionnaire.

Remark: for the purpose of this inquiry the term "practical work" or laboratory activity means experiments/investigations performed by the teacher as demonstration, series of experiments and observational exercises carried out by students in the laboratory or in the classroom or elsewhere.

Please refer to your own experience, take it easy and complete the form independently of your follow students.

General Direction

1. Do not write your name.
2. Please write other relevant information following the request of the format.
3. Tick with a Mark (✓)your responses to the space provided except the items which require written responses.
4. Additional comments in any section of the form will be welcomed.
5. Since this research is designed for improvement of your practical skill fill free and confident to write any relevant idea for this study.

Thank you in advance, for your cooperation.

Part-I: - General Information

A. Name of the school_____

B. Zone_____

C. District_____ kebele _____

D. Sex: - MaleF Age _____

E. Your Grade level: - Grade 9 Grade 10 ade 11 G 12

F. Number of students in your class: _____

Part-II Instruction: - indicate your responses by circling the appropriate answer for the questions except the questions which require written responses.

1. To what level do you agree your school have an organized chemistry laboratory?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

2. What is your agreement on our school having a separate lab room for chemistry subject?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

3. To what extent do you believe on functionality of chemistry laboratory in your school?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

4. Have you ever observed any chemistry demonstration during the first and second semester of the current academic year 2012 Ethiopian Calendar?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

5. If your answer for question 4 is 'agreed' how many times do you involve in practical activities in each semester? i. First semester _____ ii. Second semester _____

6. What is your agreement on getting sufficient practical skill and opportunity for lab activities?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

7. Do you know the meaning and use of "Laboratory and practical work in chemistry?"

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

8. Is laboratory activity in your school: -

A. More of student center approach B. More of teacher center approach C. Both student and teacher centered approach D. Any other specifies_____

9. Are there adequate facilities such as laboratory materials and reagents in your school laboratory for chemistry practical works?

A. Strongly agree B. Agree C. Undecided D. Disagree E. strongly disagree

10. To what extent do you believe that learning chemistry should be supported with practical activities?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

11. To what extent do chemistry teachers of secondary schools give attention and emphasis to practical activities and encourage you to actively participate in laboratory activities?

A. Great concern and commitment B. Few concern and commitment C. No concern and commitment at all. D. It is average

12. To what extent do you think that your teachers have the sufficient skill, experience and professional responsibility for conducting lab activities to promote your understanding of chemistry knowledge?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

13. To what extent do you agree on the idea that practical activities should carry a certain amount of percentage from the total score/mark?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

14. Do you think using demonstration of experiments by the teachers during teaching chemistry in your school?

A. More relevant B. Less relevant C. insignificant D. relevant E. undecided

15. What is your agreement on the idea that laboratory/ practical work have a great contribution on students' achievement in chemistry scores?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

16. Do you have well-trained laboratory technician/lab assistant at your school?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

17. What factors do you think that would affect or hinder the performance of practical activities at your school?

A. Are they lack of apparatus? B. Are they lack of reagents? C. Lack of commitment and awareness? D. Large class size? E. Teachers work load? F. Mention others?

18. To what extent do you think the experiments demonstrated by the plasma TV replace the real experiment taking place in the class room or in the laboratory?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

19. Is there a science laboratory club (i.e. Biology, chemistry and Physics lab clubs) in your school? A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

20 .What is your agreement with the formation and functioning of science laboratory club in your school? A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

Thank you a lot!

Appendix II

Madda Walabu University

College of Education and Behavioral Studies Department of Curriculum and Teachers Professional Development Studies

Questionnaire to be filled by teachers

The purpose of this questionnaire is to collect information about the current practices and challenges of practical activities implementation at Adaba district. The information gathered through this questionnaire will be used only for the research purpose and you are confidently assured that your response will be held in strict confidentiality. Therefore you are kindly requested to fill the questionnaire genuinely and responsibly for it is the chief determinant to the success and truthiness of the study. The researcher would like to express his thanks to you in anticipation for devoting your time, experience and energy to complete this questionnaire.

Remark: for the purpose of this inquiry the term "practical work" or laboratory activity means experiments/investigations performed by the teacher as demonstration, series of experiments and observational exercises carried out by students in the laboratory or in the classroom or elsewhere.

Please refer to your own experience, take it easy and complete the form independently of your follow students.

General Direction

1. Do not write your name.
2. Please write other relevant information following the request of the format.
3. Tick with a Mark (✓)your responses to the space provided except the items which require written responses.
4. Additional comments in any section of the form will be welcomed.
5. Since this research is designed for improvement of your practical skill fill free and confident to write any relevant idea for this study.

Part-I: - General Information

A. Name of the school_____

B. Zone_____

C. District_____ kebele _____

D. Sex: - Male ☐ Female ☐ Age _____

E. Qualification ☐

i. Certificate ☐

ii. College diploma ☐

iii. BSc /BA/BEd ☐

iv. MSc/MA/MEd ☐

v. Any other (specify) _____

F. Present Appointment i) Full time ☐ ii) Part-time ☐

G. Years of Teaching Experience

i. less than 3 years ☐ 11-14 years vii. 23 and abo ☐

ii. 3-6 years ☐ v.15-18 years ☐

iii. 7-10 years ☐ vi.19-22 years ☐

H. Number of work load per week _____

I. Grades you teach _____

K. Average class size _____

Part–II: - Teachers opinion on the relevance of practical or laboratory work in teaching chemistry.

General Direction: - indicate your responses from the given possible alternatives for each item by circling the appropriate answer except for those questions which require written responses.

1. What is your agreement on the functional laboratory classroom with basic laboratory tools and equipment in your school?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

2. What is your agreement on the presence of separate laboratory room for chemistry subject?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

3. Do you include laboratory/practical activities in the annual lesson plan of your chemistry teaching? A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

4. How do you evaluate the availability of suitable conditions and adequate materials for conducting laboratory activities in your school? A. Yes, it is complete B. Not satisfactory C. It is average D. Almost none E. Satisfactory

5. Please write the total number of activities, experiments or demonstrations that are suggested to be done in the text book of the grade (s) to which you have been teaching.

Subject	Lab activities at each grade level			
	9	10	11	12
Chemistry				

6. How many of the activities did you perform in the last three years including the current academic year?2010 Ethiopia Calendar _____ 2011 Ethiopia Calendar _____ 2012 Ethiopia Calendar _____

7. For the above question, if you did not perform some or all of the suggested activities, what would be your reason for not doing so? Mention briefly_____

8. Is it chemistry laboratory activities more of?

a. Student-centered? Reason _____

b. Teacher centered? Reason _____

c. Both teacher and student centered? _____

d. Mention any other _____

9. How do you evaluate the contribution of your school chemistry laboratory activities in facilitating the teaching-learning process and supporting theories with practices? It is

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

10. How is your need of current and regular workshop about laboratory activities to inspire and conduct practical activities more efficiently?

A. Very necessary B. I have sufficient skill, no need workshopC. It is somewhat good D. it is meaningless and not necessary. E. It is average

11. To what extent do you agree on regularly scheduled period for chemistry laboratory session/ practical activities your school?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

12. If your response is "agree" for the previous question above how many period(s) or hours are allocated for laboratory activities per period or semester? _____

13. How often do school principals and department heads monitor and evaluate the implementation of practical activities as planned by the curriculum parallel to teaching the theoretical aspect of chemistry? A. Yes, it quarterly based. B. It is rarely done. C. Yes, it is semester based D. No such tradition at all. E. Yes, it is once a year.

14. What is your level of agreement on the idea that there is well-trained laboratory technician/lab assistant at your school?

A. Strongly agree B. Agree C. Undecided D. Disagree E. Strongly disagree

Thank you very much!

Appendix III

Madda Walabu University

College of Education and Behavioral Studies Department of Curriculum and Teachers Professional Development Studies

Open-ended questions for teachers

The purpose of this questionnaire is to collect data for the research conducted to investigate the practice and challenges of implementing practical activities in teaching chemistry in high schools of Adaba district, in order to show the practice and to find out problems and indicate possible solutions for the problems encountered. Thus sir, /madam/ as a school teacher your genuine response to this interview has significant role for this research. Accordingly, I kindly request your cooperation. I thank you in advance for your cooperation!

Write out what you feel about the following questions.

1. How do you teach chemistry practical work? Is it using laboratory work? If so, how?

_____

_____

2. What are the major problems that can hinder in the implementation of teaching-learning practical work of chemistry in your school?

_____

_____

3. What do you think about problems of implementing practical work in teaching chemistry in your school?

_____

4. What is your general opinion about the relevance of practical activities in chemistry teaching at secondary school?

_____

_____

5. What are effective ways for successful implementation of practical activities at secondary schools in order to produce scientifically qualified and practical oriented students?

_____

_____

Appendix IV

Madda Walabu University

College of Education and Behavioral Studies Department of Curriculum and Teachers Professional Development Studies

Questions related to teachers attitude toward the implementation of practical work.

Strongly Agree=5 Agree=4 Undecided=3 Disagree=2 strongly disagree=1

No	Items	Rating Scale				
		1	2	3	4	5
1	What is your level of agreement on the teaching practical work method increases the academic performance of learners.					
2	For me, practical teaching is serving as a teaching strategy using a variety of project activities and laboratory work technique.					
3	To what extent do you agree on giving immediate feedback for the learners about their practical?					
4	Indicate your level of agreement about health and safety issues in school laboratory.					
5	How can you see understanding of students on the concepts of practical activities?					
6	To what extent do you agree laboratories are big enough to allow practical activities to be done by all students at the same time other than doing it shifts in the case of smaller laboratories?					
7	Indicate your level of agreement on the presence and role of lab technicians.					
8	What is your level of agreement on the effective laboratory practice requires skills and professionalism.					
9	Put your level agreement on the idea of laboratories are well equipped with the right kind of apparatus and chemicals.					
10	What is your level of agreement on the presence program coverage for practical instruction?					

Questions related to the practice of implementing practical activities in chemistry.

Strongly Agree=5 Agree=4 Undecided=3 Disagree=2 strongly disagree=1

No	Items	Rating scale				
		1	2	3	4	**5**
1	What is your level of agreement on using different practical work techniques like projects, constructivist view learning, laboratory work, scientific knowledge and etc during practical instruction?					
2	Indicate your level of agreement on the presence organized relevant chemistry laboratory for practical activities.					
3	I would like to spend more time in chemistry laboratory and I enjoy.					
4	I encourage students to take responsibility for their own learning.					
5	I can get immediate and continuous feedback on my practical work implementation from director and supervisor.					
6	I use lesson plan for laboratory class always.					
7	To what extent do you agree to know aim and importance of every laboratory activities?					
8	To what level do you agree on practical work is essential for giving students a feel for the problematic of measurement and an appreciation of the ever presence of measurement error.					
9	Indicate your level agreement on use of demonstration experiments rather than student experiments.					
10	To what extent do you agree practical work is replaced by non-practical learning activities, such as video recordings of real objects and events or computer simulations?					

Appendix V

Madda Walabu University

College of Education and Behavioral Studies Department of Curriculum and Teachers Professional Development Studies

Questions related to the challenges of implementing practical work in teaching chemistry.

Strongly Agree=5 Agree=4 Undecided=3 Disagree=2 strongly disagree=1

No	Item	Rating scale				
		1	2	3	4	5
1	What is your level of agreement on having basic skills of doing experiments in laboratory class?					
2	For me practical work is serving as teaching strategy using a variety of project activities and laboratory work technique.					
3	I have got different training opportunities on the implementation of chemistry laboratory work in my school.					
4	There are enough laboratory manuals in my school to conduct practical work chemistry.					
5	To what extent do you agree on there is infrastructure like chairs, chalkboards, apparatus, chemicals etc for teaching chemistry practical work?					
6	What is your level of agreement on class size of your laboratory to do practical activities?					
7	To what extent do you agree about safety materials for conducting practical works in laboratory class?					
8	What is your agreement on working conditions of apparatus and chemicals in your laboratory?					
9	Do you agree on the idea that your schools have sufficient program coverage for practical work activities?					
10	Indicate your level of agreement on laboratory class size, basic infrastructures and facilities.					

Appendix VI

Madda Walabu University

College of Education and Behavioral Studies Department of Curriculum and Teachers Professional Development Studies

Interview Questions for Secondary School Supervisors and Directors.

The purpose of this interview is to collect data for the research conducted to investigate the practice and challenges of implementing practical activities in teaching chemistry in secondary schools of Adaba district, in order to show the practice and to find out problems and indicate possible solutions for the problems encountered. Thus sir, /madam/ as a school teacher your genuine response to this interview has significant role for this research. Accordingly, I kindly request your cooperation.

I thank you in advance for your cooperation!

1. Could you tell me your responsibility/position in the school?
2. What do you think about the current practice of implementing practical activities in teaching chemistry regarding:-
   - The way of chemistry teacher's performance on practical activities in all grades.
   - Involvement of the learners in the teaching-learning practical activities of chemistry.
   - The system of giving feedback to the learners.
3. Do you think teaching-learning practical activities chemistry properly practiced in secondary schools? If how?
4. What are the major challenges of implementing practical activities in teaching chemistry in your school?
5. What do you think about the current practice of implementing practical activities in teaching chemistry in your school?
6. Do you think is the follow up, support and feedback system on how to implement practical activities in secondary schools by all concerned bodies?
7. What are the major problems that hinder the implementation of laboratory work in secondary schools?
8. How do you explain the implementation of chemistry practical activities in your school?
9. Is there a budget for chemistry laboratory activities, where does the source come?
10. If there is no budget to the laboratory, how could you repair when laboratory tools, electrical apparatus or pipe lines are damaged and when you need to purchase new tools and reagents?

Appendix VII

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Part-One-General information

1.1 .Name of the district_____

1.2. Name of the school_____

1.3. Observed grade level_____

1.4. Class size Male _____ Female _____ Total_____

1.5 .Date of observation_____ period _____

Part-Two teacher's information

2.1 teacher's name_____2.2 Sex_____2.3 Age_____

2.4 Qualificaion_____2.5 Experience_____

Use (X) to show your level of agreement.

I. observation checklist about classroom and laboratory facilities

No	**Observed items or issues**	**Level of rating**			**Remarks**
		Adequate	Medium	Low	
1	The size of the classroom				
2	Number of chairs for the learners				
3	Condition of the chalk board				
4	Enough light to see in the class				
5	Desks to write on				
6	Laboratory room				
7	Chemicals in the laboratory				
8	Apparatus/equipments				
9	Electric light in the laboratory				
10	Water in the laboratory				
11	Students seats in the laboratory				
12	Working bench in the laboratory				
13	Laboratory technician				
15	Functional plasma TV program				

II. Observation checklist for the instructional materials

No	Observed items	Level of rating			Remarks
		1:1	1:2	>1:2	
1	Chemistry text book				
2	Manual of laboratory				
3	Teacher guide of chemistry				
4	Chemistry reference book				

III. Instruction: - for the following criterion put a tick mark about the implementation of practical activities when observation takes place in the classroom or laboratory in front of each item. V.G= very good (4), G= good (3), F= fair (2), P= poor (1), N= none (0)

No	Criterion/item	Rating scale					Remark
		P	F	N	G	VG	
1	Teacher's preparation and awareness to lab activities.						
2	Time allotment/duration of time						
3	Students involvement (student centered)						
4	Conducting experiments/demonstration						
5	Motivation to practical works						
6	Clarification of concepts and terms relation to laboratory activities						
7	Engaging students for lab report after conducting experiments						
8	Conducive environment for lab activities (ventilation, light, class size, silence, etc)						
9	Measurement and evaluation of practical work						
10	Management of practical work						

IV. Instruction: - for the following items about the adequacy of conditions for practical work, please indicates your response using the scale by putting a tick mark (✓) in front of each statement. Rate each item as S= Satisfactory, NS= Not Satisfactory, SL= Serious Limitations

No	Item	Rating scale			Remark
		S	NS	SL	
1	Time allotment for lab work				
2	Laboratory facilities				
3	Current supply of equipment				
4	Availability of trained lab technician				
5	Class size and number of students				
6	Chemistry teachers interest and commitment to conduct lab session				
7	Students participation and interest to lab works				
8	Support and encouragement offered by school principals.				
9	Provision of laboratory workshops, seminars and training to teachers				
10	Annual budget allocated for purchase of equipments, reagents and other resources				

Appendix VIII

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Document Analysis Check List

Zone _____ district _____ Name of the School_____

Date _____ Time_____

Instruction: - Check and confirm the following points concerning document analysis

1. Does the school include laboratory program/experiments to be done in its annual plan?

A. Yes B. No

2. Is there a posted/prepared practical work schedule in the laboratory classroom?

A. Available B. Not available

3. Does the school have separate laboratory classroom?

A. Yes B. No, it is combined

4. Is it currently fully functional and have the basic facilities?

A. Yes, complete B. partial C. Not functional

5. Is there any chemistry manual in the school?

A. Yes, available B. Not, available

6. Does the school record and document teachers and students' participation of chemistry practical works?

A. Yes, available B. Not, available/ not recorded.

7. Are there lists of lab equipment and reagents posted on the laboratory board?

A. Yes, it is posted B. No, lists of equipment and reagents

8. Regarding laboratory assistant

A. Well- trained B. Un-trained/not receiving any neither training nor workshop

C. No lab assistance /technician

9. Is there a copy of a report document prepared by the department head or the teacher on time frame that has been submitted to the school director?

A. Available B. Not available or No report preparation.

10. Is there a syllabus or curriculum in the school laboratory for reference regarding the objective, relevance and process of implementation of practical activities in chemistry subject? A. Available B. Not, available

13. Is annual budget allotted for the chemistry laboratory? A. Yes B. No