THE IMPLEMENTATION OF SCIENCE LABORATORY ACTIVITIES AT SECONDARY SCHOOLS OF OROMIA SPECIAL ZONE SURROUNDING FINFINE

By

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Declaration

Hereby, I, Abera Wakessa Gemeda, do declare that, this thesis entitled "The Implementation of Science Laboratory Activities at Secondary Schools of Oromia Special Zone Surrounding Finfine " is my own original work and that all sources of materials used for this thesis have been properly acknowledged. This thesis has been submitted in partial fulfillments of the requirements for MA degree at Jimma University. I declare that this has not been submitted partially or fully to any other institution for the award of any academic degree, diploma, or certificate.

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Letter of Approval

The thesis entitle as "The Implementation of Science Laboratory Activities at Secondary Schools of Oromia Special Zone Surrounding Finfine" conducted by Abera Wakessa Gemeda under the guidance and supervision of Dr. Abbi Lemma main advisor and dr. Abera Hussien co-advisor has been approved for the degree of masters of Arts (MA) in Curriculum and Instruction.

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ACRONYMS AND ABBREVIATIONS

FSS Forum for Social Studies.

Lab. Laboratory.

MoE Ministry of Education.

OSZSF Oromia Special Zone Surrounding Finfine.

SMASEE Strengthening Mathematics And Science Education in Ethiopia.

SNNP South Nations, Nationalities and Peoples

SPSS Statistical Package for Social Science

UNESCO United Nation Education Science and Culture Organization

ZEO = Zone Education Office

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Abstract

The major purpose of this study was to assess the implementation of science laboratory activities in government secondary schools of Oromia Special Zone Surrounding Finfine. Amixed method research approach and convergent parallel design was emloyed for the study. Woreda and town education offices and secondary schools were selected by purposive sampling technique based on their proximity. The secondary school principals and vice principals, Science teachers and `supervisors were selected using census or parametric method in order to get sufficient information where as the students were selected by simple random sampling technique. In addition, purposive sampling was used to select principals and supervisors for interview. Data were gathered from science teachers, principals, vice principals and 383 students by questionnaire. Besides, semi structured interview was conducted with school principals and supervisors. In the same way observation and document analysis such as Laboratory annual plans, laboratory activity reports and school annual reports were done by the researcher. The data gathered through questionnaires were analyzed using frequency and percentages whereas the qualitative data gathered through interview, observation and document analysis were organized and narrated in words. The findings of the study indicated that: - a) The implementation of Science laboratory activities in secondary schools of Oromia Special Zone Surrounding Finfine is in a very low level where science teaching learning process was not supported adequately by laboratory activities; b) The most common factors that affect the implementation of science laboratory activities in secondary schools of the study area 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 and lack of regular schedule for laboratory activities. c) Laboratory activities did not get the necessary concern in all schools investigated by this study. Therefore, to bring the progress of laboratory activities in schools and to play a great role in initiating and supporting science teaching in the class, all stakeholders such as science teachers, school principals, supervisors and educational officers should be given an awareness and get current and sustainable workshops and trainings. Generally, government bodies such as Oromia special zone surrounding Finfine education offices, Oromia education Bureau and Ministry of education should give special attention for the improvement and effective implementation strategies of science laboratory activities in the study area.

Keywords: Laboratory, Laboratory activities, Laboratory room, Principals, Secondary School, Teacher**,**

CHAPTER ONE: INTRODUCTION

This introductory chapter presents the background of the study, statement of the problem, general and specific objectives of the study and the research questions, significance of the Study, Delimitation of the study, Limitation of the study, Operational definition of key terms and organization of the study.

1.1. Background of the Study

Education is the key instrument for national development which is used to develop human capital for effective functioning of the society. Science education, in particular contributes a lot to human development in the areas of medicine, agriculture, environmental protection and food security. Moreover, it is important for students in their everyday life, in global competitiveness, resource utilization and environmental care, in problem-solving skills, and understanding of the scientific methods (Kuddus, 2013). This can be realized when the quality of Science education is attained at better standards.

Science is derived from the Latin word *"scientia"*, meaning "knowledge" which is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe (Lindberg & David, 2007).

Science education is the developing of technologically literate citizens who understand how science, technology, and society influence one another and who are able to use this knowledge in their everyday activities (Beyessa, 2014). The quality, relevance, methods of teaching, human resource, scientific literacy, science process skills, higher order thinking, science-technology-society, teachers quality, textbooks of science education directly impacts on the extent of growth and development of science and technology (Tesfaye etal., 2010). The development of a modern civilization has a lot to do with advancement of science and technology. Focusing on the Science and Technology Education is becoming common goal for nations to increase their developmental level (Weil-Barais, 2001).Since advancement in science and technology help as a tool for boasting countries economic, social and political development. To achieve this goal Science education should supported by Laboratory practical activities in teaching learning process.

Laboratory activity is an active and interactive ways of teaching and learning method, which requires students to be involved in observing or manipulating real objects and materials, have a key and typical role for the development of students' understanding of scientific concepts, improving their cognitive skills, developing positive attitudes as well as stimulate students to greater efforts of achievement (Hunt, Koender, & Gynnild, 2012). Laboratory practical experiences are central goals to Science education for the achievement of scientific proficiency.

It is believed that practice is at the heart of mastery of science discipline. If there is no practice either individually or in a group all what have been learnt become inert knowledge (Jonassen, 1991). Mostly science practice takes place in science laboratory. Science laboratory is a very important resource input for teaching science and is an important predictor of academic achievement (Dahar, 2011). Science laboratories made this world very advanced and scientific in its purposes.

Many researchers suggested that when students engaged in science laboratory for practical experiments, they enhance and improve their level of understanding, (Hofstein and Lunetta, 2003; Hofstein, 2004). The laboratory has been given a central and distinctive role in science education, and science educators have suggested that rich benefits in learning science come as a result of using laboratory activities (Hofstein and Lunetta, 2003).

Science education provides good standards for people and leads to cultural developments. It would seem clear that all the developing countries should accelerate the development of science education as action oriented, and project based education program. In Ethiopian context, the Government has recently introduce policy of 70:30 percent professional mix in annual enrolment, with 70% of intakes allocated in to science and technology streams and 30% in to the social science and humanity steams. The rationale behind this initiative is the belief that science and technology are the engines of development and that Ethiopia's prospect hinges on the availability of sufficient stock of national expertise in these fields by its higher institutions (FSS, 2009).This shows that, the country has intended to reduce its dependence on the imported expertise and technology. However, research in Ethiopia indicated that students beginning from lower grades have serious knowledge deficits in science and mathematics; this signifies that the quality of science education in primary and secondary schools, which is critical foundations for

latter educational development, is at crisis (Solomon Gunta & Kedir Ousman 2015). At this point it looks imperative to raise some questions related to the 70:30 professional mix proposed by MoE. How it is possible to place 70% of preparatory graduates to higher learning institution in science stream where students have no chance in conducting science laboratory activities at secondary schools (FSS, 2009). Therefore the researcher was interested to assess the implementation status of science laboratory activities in various secondary schools in Oromia special zone surrounding Finfine and he seeks to indicate possible solution to the problems.

1.2. Statement of the Problem

As discussed in background part earlier, Laboratory activity is an active and interactive ways of teaching and learning method which requires students to be involved in observing or manipulating real objects and materials (Hunt etal., 2012). According to Wiley (2000), teachers perform practical and demonstrations when the school has laboratories, equipments, chemicals and reagents. If the laboratories, equipments, chemicals and reagents are not present, science teacher prefer lecture methods. But the chalk and talk nature of secondary science education is the poor method of teaching in which all what have been learnt become easily forgotten in short period of time (Jonassen, 1991). Efforts to reform secondary science education through the implementation of laboratory activity and more inquiry-oriented pedagogy become effective if science teachers are supported with adequate laboratory facilities, science equipment and with high quality technical support. Science laboratory activities implementation requires above all qualified, well trained laboratory technicians, teachers and dedicated leaders; hence, assessing the resources and challenges in carrying out the science laboratory problems becomes necessary.

A number of reviews and reports on secondary science education (Tytler, 2007) have highlighted problems with the engagement students' in science laboratory activities. These reviews and reports emphasized mostly on students' less interest to participate in science laboratory activities.

In Ethiopia most of the research has been concentrated related to Science Laboratory activity. For instance, Tolessa Muleta et al**.** (2016) conducted his research on Status of biology laboratory and practical activities in some selected secondary and preparatory schools of Borena zone. The study revealed that, less attention was given from administrative government of the region and

school administrators to science laboratory activity and it made negative impact on students' preference to science education.

Another study by Solomon Gunta & Kedir Ousman (2015) was also conducted on Problems in the Teaching and Learning of Physics at Secondary and Preparatory Schools in SNNP Regional state: the Cases Wolaita and Dwuro Zones, the study result showed that, physics class room teachers never and rarely used laboratory for practical work due to the lack of interest and equipment in the laboratory. Besides these, Belay Tafa (2012) studied about Laboratory Activities and students practical performance: The Case of Practical Organic Chemistry I Course of Haramaya University and the results indicated that the majority of the activities have lower inquiry and the dominant practical work identified was demonstration type activity.

All the above mentioned studies emphasized on the status and factors affecting the practical activities in science education in secondary and preparatory schools. Therefore, the current study differ from those studies in its' purpose and scope in which its' purpose was to assess the implementation of science laboratory activities rather than studying the status and problems in implementing laboratory activities. Besides to this, the current study also differ from the previous studies due to it focused on secondary schools and included three science subjects(Biology, Chemistry and Physics) than focusing only on a single subject. Further, the researcher included teachers, principals, supervisors and students in a sample and also interested to investigate the nature of technical support, the role of technicians, teachers commitment, the presence of equipped laboratory rooms and how they were working as well as assessing the major factors that affect the implementation of laboratory activities in the study area. In addition to this, no one has studied the implementation of science laboratory activities in Government secondary schools in the context of Oromia Special Zone Surrounding Finfine. Thus, the researcher used this gaps and own observation while teaching chemistry in different secondary schools and worked in different level of education sector in the study area as a driving force to explore the issue in detail. To this end the following basic research questions were set:

1. What do the implementation status of science laboratory activities look like in secondary schools of Oromia Special Zone Surrounding Finfinne?

2. To what extent science laboratory activity is supported by qualified laboratory technicians at the study site?

3. What are the major factors that affect the implementation of secondary school laboratory activity?

1.3. Objectives of the Study

1.3.1. General Objective

To investigate the implementation of science laboratory activities at secondary schools of Oromia special zone surrounding Finfine.

1.3.2. Specific Objectives

1. To indicate the implementation status of science laboratory activities in secondary schools of Oromia special zone surrounding Finfine.

2. To identify to what extent science laboratory activity is supported by qualified laboratory technicians.

3. To find out the major factors that affects the implementation of Science Laboratory activities in secondary schools of the study area.

1.4. Significance of the Study

The effective implementation of Science laboratory activities can have a great importance in improving the quality of science education. Therefore, the study is very important to examine the extent to which science laboratory activities are currently implementing in secondary schools of Oromia special zone surrounding Finfine. Thus, the findings of the study might have the following significances:

- ✓ It would provide necessary information for policy makers, planners, School principals, Education office Strengthening Mathematics And Science Education in Ethiopia expertise, teachers and other concerned groups to realize the magnitude of the problem so as to take immediate remedial action.

- ✓ It might be identify factors affecting the implementation of secondary school science laboratory activities and give emphasis in alleviating such problems.
- ✓ It would provide recommendations for stakeholders that would mitigate the existing problems.
- ✓ It might motivate students to actively engage in performing science laboratory activities to enhance their practice based knowledge in science education.
- ✓ The study may generate interest or serve as a spring board for further studies in the area.

1.5. Delimitation of the Study

Conducting the study on the implementation of Science laboratory activities in secondary Schools of Oromia was a critical issue. But to conduct a research in all Oromia secondary schools was impractical because of limitation of resources and time. So, to make the study specific and manageable, it was delimited to governmental secondary schools of Oromia Special Zone Surrounding Finfinne.

Therefore, the study was delimited geographically to Oromia special zone surrounding Finfinne, thematically enclosed to assess the implementation of Science Laboratory activities in public secondary schools, disciplinary, delimited to three Science subjects(Biology, Chemistry and Physics) and timely, the study was conducted from December 2018 to October 2019.

1.6. Limitations of the Study

The study enclosed only to assess the implementation of science Laboratory activities at secondary schools of Oromia Special Zone surrounding Finfine. In this study, the researcher faced various limitations during data collection. The major limitations were time constraints and shortage o budget. In addition, shortage of local empirical researches related to the issue and lack of experience among the researcher were another limitation.

1.7. Operational Definition of key terms

Science: is the study of natural world based on facts learned through experiments and observation or a particular area of scientific study such as Biology, Physics and Chemistry.

Laboratory: is a room or building with special equipment for doing scientific experiments and tests.

Laboratory activity: is an active and interactive ways of teaching and learning method, which requires students to be involved in observing or manipulating real objects and materials.

Science Laboratory: is a workplace for the conduct of scientific research.

Implementation: is the act of implementing /providing practical means for accomplishing something or some aim/.

Status: the stage at which the implementation of Science laboratory activities found.

Challenges: factors that affect the implementation of Science laboratory activity.

Stakeholders: concerned bodies who have contributions for the implementation of Science laboratory activity.

1.8. Organization of the Study

The study was organized into five chapters. The first chapter gives detail about the introductory part which includes the background of the study, statement of the problem, basic research questions, General and specific objectives of the study, significance, Delimitation, the forecasted limitation and operational definitions of terms. The second chapter presents the review of literature relevant to the research and empirical review. The third chapter discussed about research methodology part with detail explanations of the research design, research approach, sampling techniques, data collection tools and method of data analysis. Chapter four treats about data interpretation and analysis. The last chapter presented summary, conclusions and recommendations of the study. Finally, reference and appendixes were also attached to this study.

CHAPTER TWO: REVIEW OF RELATED LITERATURE

This part devotes itself to present the existing literatures in the area of science laboratory activities. It begins with briefing the concept of laboratory activity and then the importance of laboratory in science education, strategies to implement laboratory activity and factors affecting the implementation of science laboratory activities in Ethiopia and specifically in OSZSF was discussed briefly.

2.1. Nature and Concept of Science Laboratory and Laboratory Activity

Laboratory has been described as a room or a building specially built for teaching by demonstration of theoretical phenomenon into practical terms. With the laboratory experience, students will be able to translate what they have read in their texts to practical realities, thereby enhancing their understanding of the learnt concepts. Farombi (1998) in Yara (2010) argued the saying that seeing is believing is the effect of using laboratories in the teaching and learning of science and other science related disciplines as students tend to understand and recall what they see more than what they hear.

Hofstein and Luneta (2003) defined science laboratory activities as "learning experiences in which students interact with materials and/or with models to observe and understand the natural world". Students learn by performing concrete activities, by comparing experimental data to a model or by designing an investigation. According to Hofstein (2004), a practical activity in science education is an activity used to engage students in investigation, discoveries, inquiries and problem solving activities and is the center of science teaching and learning.

Within an educational context, laboratory activities can be defined as tools that enable simulation of natural facts and phenomena through conventional laboratory equipment and/or reusable everyday materials (Hodson, 1994; Abrahams, 2011; Leite & Dourado, 2013) that students and the teachers handle to produce data. Hence, laboratory activities are practical activities but it should be stressed that not all practical activities are laboratory activities. For instance, paper and pencil or computer modeling problem-solving activities are practical activities but they are not laboratory activities.

2.2. Importance and Necessities of laboratory and Laboratory activities in science education

Science is an experimental (practical activity based) discipline; laboratory becomes a crucial part in enhancing students' scientific skills (Hofstein & Mamlok-Naaman, 2007; Score, 2008; Oscarsson et al., 2009; Flinn scientific, 2011; Suleiman, 2013). It is very important and essential to the teaching of science and success of any science course is much dependent on the laboratory provision made for it. Lending credence to this statement, Ogunniyi (1982) in Yara (2010) said that there is a general consensus among science educators that laboratory occupies a central position in science instruction. It could be conceptualized as a place, where theoretical work is practicalized and practicals in any learning experiences involve students in activities such as observing, counting, measuring, experimenting and recording. These activities could not be easily carried out, where the laboratory is not well equipped. There is usually a strong move to emphasize the dependence of science teaching on the existence of a well-equipped science laboratory.

Most science teachers comprehend that laboratory activities are essential in teaching science as it stimulates students' interest as well as developing their scientific skills (Dillon, 2008). Science should be different subject like history or literature that their contents can be adequately taught by the lecture method. Active learning improves learners' understanding and remembering of information and helps them to develop problem-solving and critical thinking skills (Kigali Institute of Education, 2011).Thus Laboratory activity is one of the most important parts of active learning method in science education which makes students active in science learning and help them to establish the accuracy of their beliefs.

Science laboratory is a very important resource input for teaching science and is an important predictor of academic achievement (Dahar, 2011). It made this world very advanced and scientific in its purposes. Many researchers suggested that learning science is enhanced and the understanding level is improved when students are engaged in science laboratory for practical experiments (activities) (Hofstein and Lunetta, 2004; Hofstein, 2004). However, the facilities for teaching science are not up to the standard at secondary and higher secondary school stages (Dahar, 2011).

Secondary school is the base in preparing students for science education. It is at this level where students are exposed to laboratory equipments, activities and precautions or safety rules. Secondary school laboratory should have the equipment necessary to conduct meaningful demonstrations and experiments. Teachers should understand that students with limited strength or mobility can have a full laboratory experience with appropriate accommodation, such as a lab assistant (Tenaw, 2015). Hunde and Tegegne (2010) reported that, despite the fact that laboratories have multiple benefits ranging from making learning concrete to lying basis for science education; students were deprived of such opportunities.

Many countries have given attention to the effective implementation and practice of science education at their secondary schools (Beyessa, 2014). China and India are the two outstanding countries strengthening their science curriculum standards to become economic and industrial powerhouses and in several ways compete effectively with developed countries (Hallinan and Sorensen, 1987). Malaysian Government had announced a new education policy to strengthen the education standards in science and technology to compete with advanced countries and vowed to stand in the list of developed countries in 2020 (Mahathir, 1991). The Commission for Africa report recommends that African countries have to take specific action that strengthen science, engineering and technology capacity since such knowledge and skills help countries to find their own solution to their own problem (Teshome, 2007). Similarly, the Ethiopian government determined and introduced what is now known as a "70:30 professional mix which 70% will be Science and technology streams while 30% will be Social Sciences and Humanities streams at higher education. This demonstrated that the government has given due attention to science education (Tesfaye et al., 2010).

The rationale behind this initiative is the belief that science and technology are the engines of development and that Ethiopia's prospect hinges on the availability of sufficient stock of national expertise in these fields by its higher institutions FSS (2008).The country gave more emphasis to science fields and students are expected to gain adequate practical knowledge parallel to the theoretical knowledge of science disciplines. Science laboratory activities are important to produce well qualified, scientifically literates and competent educated manpower. Practical activities have a long distinctive and central role in the science curriculum and science educators have suggested that many benefits accrue from engaging students in science practical activities

Hofstein & Lunetta (2004). Specifically inquiry-type laboratories have the potential to develop students' abilities and skills such as: posing scientifically oriented questions Hofstein, Navon, Kipnis and Mamlok-Naaman (2005), forming hypotheses, designing and conducting scientific investigations, formulating and revising scientific explanations, and communicating and defending scientific arguments. However, recent study in Ethiopia indicated that students beginning from lower grades have serious knowledge deficits in science and mathematics; this signifies that the quality of science education in primary and secondary schools, which is critical foundations for latter educational development, is at crisis. At this point it looks imperative to raise some questions related to the 70:30 professional mix proposed by MOE. How it is possible to place 70% of preparatory graduates to higher learning institution in science stream where students have low achievement in science subjects (FSS, 2008).

A number of reviews and reports on secondary science education e.g., Tytler (2007) have highlighted problems with engaging students' interest in the study of science and the teaching-learning method is less inquiry-oriented, and also the students less engage in practical science investigations. The chalk and talk nature of secondary science education is the poor method of teaching in 21st century. Today Science is more based on inquiry oriented (Tytler, 2007). Efforts to reform secondary science education through the implementation of practical and more inquiry-oriented pedagogy will only be effective if science teachers are supported with adequate laboratory facilities, science equipment and with high quality technical support.

Science laboratories are essential for the fulfillment of individuals needs as well as for the national growth and its implementation requires above all qualified, well trained laboratory technicians, teachers and dedicated leaders; hence, assessing the resources and challenges in carrying out the science laboratory activity problems becomes unavoidable and necessary. Given that, there has been no research conducted in OSZSF to investigate the implementation of secondary school science laboratory activities. Hence, there is a need to investigate the nature of technical support, the role of technicians, the teachers' commitment, the presence of separate and equipped science laboratory such as Biology, Chemistry and Physics and how they are working. The objective of the study is to investigate the implementation of secondary school science laboratory activities at secondary schools in Oromia special zone surrounding Finfine and to suggest possible solutions.

2.3. How to Implement Science Laboratory Activities in secondary school?

Science is a practical subject and its curricula should give students the opportunity to practice the processes of investigation in reliable contexts, and in secondary schools this should involve working in well-equipped and supported laboratory environments. Practical activities are essential in all level of science education and in particular it is highly significant in secondary schools to help students in internalizing and understanding the theoretical knowledge of science fields such as Chemistry, Biology and Physics. To accomplish the goal of practical activities in science, the equipment and experiments have to be carefully selected to give students a relevant experience and also the understanding is enhanced if the activities are coming from the daily life of the students. Provision of relevant equipment and reagents is a necessary, but not sufficient condition for successful science teaching (Ashebir and Bereket, 2016). The end result of using laboratory activities in science teaching is not only to help students to learn how to interpret and explain facts and phenomena but also to do it as scientists do (Abrahams, 2011).

A good science teacher should maintain an active role and consistent pace of interaction throughout the laboratory period so that students learn what to expect from him as an instructor. He should include several moments of whole class instruction at key points in the laboratory. When the teacher is asked the same question three times, or three groups have the same problem, it is likely that other groups will have the same question or problem as well. He should gain everyone's attention and use this moment to provide targeted "just in time" instruction or feedback for everyone. During the class, he should move around the room to make himself accessible to students, focusing equal time on groups that ask and those that don't ask for help. He should be aware of the progress of all student teams, address students by name whenever he get the chance, and listen to what is being said in groups to help you anticipate and diagnose instructional problems. He should not assume that since a group is quiet, they know what they are doing. He can diagnose a laboratory problem early on by observing what is being done or said in seemingly on-track groups. It is always useful, and never unappreciated, for a teacher to approach a group and prompt them with "he should tell them what he is doing" to find out if they are on the right track.(Allen, et al., 2009).

2.4. Factors that affect the implementation of science Laboratory activities

Laboratory activity has been defined as an experiment performed by the teacher for demonstrations, or series of experiments and observational exercises carried out by the students to relate theoretical knowledge with practical activities done in the laboratory (Tytler, 2007, UNESCO, 2001). Since Science is a practical subject and its curricula should give students the opportunity to practice the processes of investigation in authentic contexts, in secondary schools this should involve working in well-equipped and supported laboratory environments. To accomplish the goal of this activity in science, the equipment and experiments have to be carefully selected to give students a relevant experience and also the understanding is enhanced if the activities are coming from the daily life of the students. Provision of relevant equipment and reagents is a necessary condition for successful science teaching. The most determinant constraints of laboratory activities in secondary schools include lack of laboratory rooms, inadequate supply of lab equipments, reagents and facilities, absence of trained laboratory technicians/teachers, lack of commitment and interest of teachers, lack of regular schedule for laboratory activities, , poor management, monitoring and evaluations of laboratory activities, no system for grading and assessment of laboratory examinations(Ashebir and Bereket, 2016).

2.5. Strategies to be followed to improve the implementation of science laboratory activity

2.5.1. The Nature of the Science Laboratory Environment

The environment has been identified as one of the factors that affect both teaching and learning and an important determinant of student learning and achievement (Wong & Fraser, 1996). According to Chin, Wong and Angela (2004), there is a positive association between the nature of the learning environment and academic achievement outcomes. Besides, they further found out that the quality of the laboratory environment and the way students perceive it have a significant effect on their performance.

Huang (2006), further stated that the views of science teachers and their students especially on science learning environment such as lack of equipment for science teaching and learning has been found to be one of the factors contributing to poor performance of science students in

science. Generally to improve the implementation of science laboratory activity it is better to establish the following conditions as much as possible.

Engaging and hands-on: in order to engage students in science, the laboratory activities should include student participation as opposed to simple demonstration.

Relevant to students' lives: In order to increase students' interest and engagement, laboratory activities be relevant and applicable in students' daily lives.

Inexpensive and easy to implement*:* to implement laboratory activities at many schools, it should be clear, easy to follow instructions and require materials that could be found locally.

2.5.2. Laboratory Demonstrations

It begins by demonstrating key techniques or equipment operation or describing the location and handling of special materials. The students are gathered close to focus them on what you are doing and to ensure that everyone can see and hear. Again, they are focused on the key terms and functions that are in the procedures, and use the demonstration to generate excitement about the laboratory. The teacher should not attempt to demonstrate equipment he has not practiced using. If the teacher made mistake during his demonstration, it is instructionally important to describe how he made the mistake, it is good to familiarize him with the equipment operation prior to the demonstration. (Allen, *et al*., 2009).

2.6. Empirical Literature Review

A lot of study has been done in our country Ethiopia on the area of Science Laboratory activity issues. For instance, Tolessa Muleta et al. (2016) conducted his research on Status of biology laboratory and practical activities in some selected secondary and preparatory schools of Borena zone. Here, the purpose of the study was mainly to assess the status of Biology laboratory and practical activities. The study revealed that, less attention was given from administrative government of the region and school administrators to sciences laboratory activity and it makes negative impact on students' preference to science education.

Another study by Solomon Gunta & Kedir Ousman (2015) was also conducted on Problems in the teaching and learning of Physics at the Secondary and Preparatory Schools in SNNP Region the Cases of Wolaita and Dwuro Zones, having the purpose of assessing the problems in the

teaching and learning of physics in the study area. The study was employed descriptive survey method and included supervisors at zonal and woreda levels as the sources of data. The study result showed that, physics class room teachers never and rarely used laboratory for practical work due to the lack of interest and equipment in the laboratory. The study recommended that, teaching Physics should encompass a combination of lecture, accompanied by practical demonstrations, tutorial and range of laboratories. Besides these, Belay Tafa (2012) studied about Laboratory Activities and students practical performance: The Case of Practical Organic Chemistry I Course of Haramaya University and the results indicated that the majority of the activities have lower inquiry and the dominant practical work identified was demonstration type activity.

Furthermore, studies by different researchers, Tolessa and Muhammed (2016) were conducted related to Factors Affecting Implementation of Practical Activities in Science education in Some Selected Secondary and Preparatory Schools of Afar Region. The study was conducted having the purposes of assessing factors affecting implementation of practical activities in science education. The result of the study revealed that Absence of separate and well equipped laboratory for each science and absence of efforts made by science teacher to use local material for practice of basic activities and less attention of local government and school administrative to existing problem results in less student motivation to practical activity which have an influence on student's preference to science education in the study area.

In general, many literatures gave more emphasizes on the status and factors affecting the practical activities in science education in secondary and preparatory schools. Moreover, there is no similar study conducted on the Implementation of science Laboratory Activities in the study area. Recognizing this gap and adding own observation, the researcher was initiated to study the Implementation of science Laboratory Activities within the particular area of Oromia Special Zone Surrounding Finfine.

2.7. Theoretical Framework

The researcher embraced Jerome Bruner's constructivism theoretical arguments that learning is an active process in which learners construct new ideas or concepts based upon their current or past knowledge, (Bruner, J. 1996). He also argued that humans generate knowledge and

meaning from interaction between their experiences and their ideas. The theory is associated with pedagogic approaches that promote active learning and discovery processes. Hands on experiences are therefore necessary for effective learning as the learner is required to do something in the process of learning. Teachers should try and encourage students to discover principles by themselves. Science teachers can achieve this by giving practical activities in the laboratory. The various laboratory experiences expose the learners to hands on activities thus actively participating in the learning process. If well planned in a properly set laboratory, laboratory experiences can develop scientific thinking and also develop practical abilities.

2.8. Conceptual Framework

The conceptual framework of the study relates the various ways or methods of teaching Science. A hand on activities intensifies the understanding of various Science concepts. Though several methods can be used to teach Science, Dale (1969), observed that different methods require different resources. It is therefore the role of the teacher to choose the most appropriate method to use. However, the method to be adopted for use depends on several factors. According to Wellington (1989), these factors include the learner, the learning objectives and resources available as the determinant factors for teaching sciences. The teacher should consider the objective to be achieved, the learner and the nature of the content to be taught. Equally, the science teacher should be well equipped with the use of a variety of methods and procedures of teaching science. Layton (1989) indicates that whichever method a teacher adopts for a lesson, it must aim towards effectiveness in quantity (quality benefiting the learners) and quality (effectiveness) of learning. Most learning tasks involve a combination of any of the following process; recognition, memory algorithmic, problem solving, understanding and change of attitude. To achieve any of these processes require a particular instructional approach or a combination of approaches.

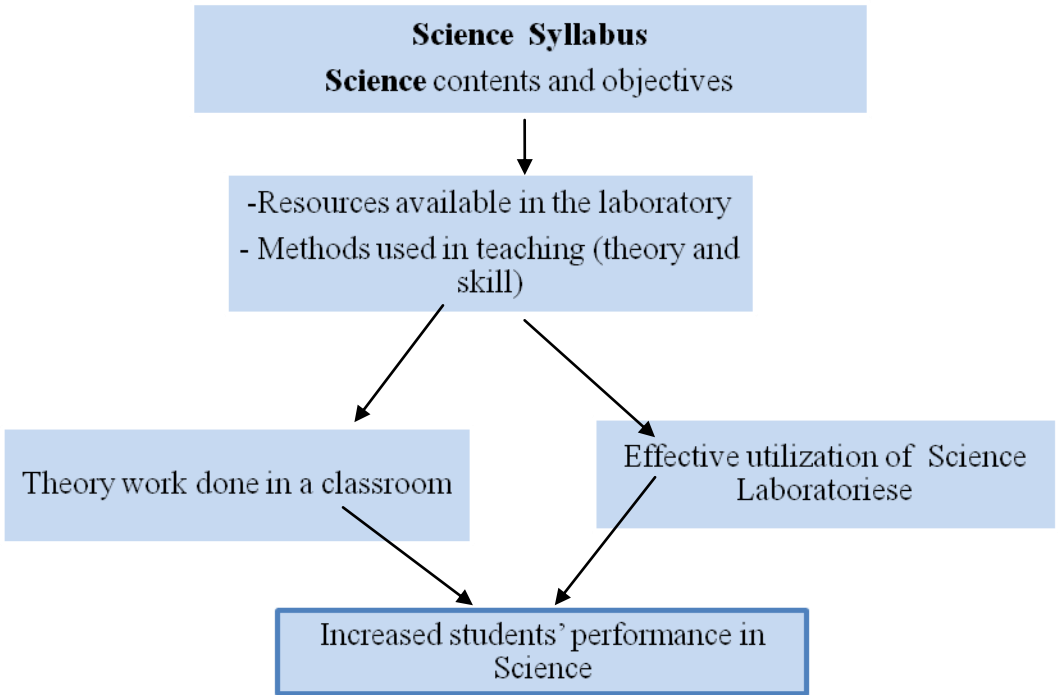
In secondary school teaching, the Science content is well elaborated in the Science syllabus. The syllabus provides the objectives for teaching Science as well as the time limit for every topic. The syllabus is thus very important in teaching Science and Science teachers are expected to implement the curriculum through teaching the content as it is in the syllabus. The methods of instruction are various depending on the nature of the content. Some content involves theory

work and the instruction can be in classroom. These include; concepts, laws, use of various substances and applications of various processes in real life situations.

However, others involve practical work and can only be taught using Science laboratory. These include acquisition of skills such as handling of apparatus, reading calibrations, observing phenomena and ability to follow procedures (manipulative skills). Also taught in the laboratory are the various process skills. The theory and the practical concepts complement each other. The theory and the practical content are therefore equally important and should be taught effectively in order to realize good results. Performance in Science depends on how well the two are done.

In teaching Science, the syllabus is the main reference. Teaching can be done using the various methods. It can also be done in various places. The theory can be taught in the classroom while the practical is done in the laboratory. Both theory and practical reinforce each other. This study focused on the practical work done in the laboratory.

Figure 1: conceptual framework



CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

This section deals with description of the Study area, the research Approach, methods, source of data, sample size and sampling techniques, data gathering instruments and procedures for data collection, methods of data analysis that were employed and Ethical issues.

3.2. Description of the Study Area

The study was conducted in Oromia Special Zone Surrounding Finfine (OSZSF). OSZSF is one among eighteen zonal administrations of Oromia regional state. As the name implies, OSZSF is found surrounding Finfine (Addis Ababa), at center of the country Ethiopia and Oromia Regional state. The zone found bounded by four other Zonal administration of Oromia namely: West Shoa zone in the West, East Shoa zone in the East, South West Shoa Zone in the South, and North Shoa zone in the North East. OSZSF currently has six wereda and eight town administrations. The six wereda administrations are namely: Akaki, Welmera, Sebeta Hawas, Sululta, Mulo and Bereh where as the administrative towns found in OSZSF are: Dukam, Holeta, Sebeta, Sululta, Burayu,Laga Tafo laga Dadi, Gelan and Sendafa. The Zone administration is located in Finfine/Addis Ababa around Gotara (OSZSF profile, OSZSF Economic Development Cooperation Office, 2012).

3.3. Research Approach

A research approach is the set of methods and procedures used in collecting and analyzing measures of the variables specified in the research problem (Creswell, 2014).There are three types of research approaches namely qualitative, quantitative and mixed methods. Mixed methods research is an approach to inquiry involving collecting both quantitative and qualitative data, integrating the two forms of data, and using distinct designs that may involve philosophical assumptions and theoretical frameworks (Creswell, 2014). According to Dawson (2002), combining both quantitative and qualitative research approach is high-quality; it enables counteract the weakness in both quantitative and qualitative research. It enables the researcher for in depth looking of the problem to get supportive results. The combination of the two research approaches gives better interpretation as the information missed by one was fulfilled by

the other. Accordingly, the researcher used a mixed methods approach which involves the integration of both quantitative and qualitative data in a study because of its provision of more complete understanding of a research problem than either approach alone.

3.4. Research Design

Research design is a comprehensive plan provide for collection of relevant data in conducting study to minimize expenses of effort, time, and money (Kothari, 2004 and Bhattacherjee, 2012). As mentioned under 3.3, a mixed methods approach involves both qualitative and quantitative data and it also contains convergent parallel, Explanatory and Exploratory designs. According to Creswell (2014), Convergent parallel mixed methods is a form of mixed methods design in which the researcher converges or merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. In this method, the researcher typically collected both forms of data at roughly the same time and then integrates the information in the interpretation of the overall results. Therefore, a side-by-side comparison approach was used in which the researcher first reported the quantitative statistical result and then discussed the qualitative findings that might either confirm or disconfirm the statistical results at the level of data analysis. . Hence, the laboratory technicians, teachers, the laboratory resources availability, school leadership commitment for the better attainment of science subjects and the challenges that encountered in science laboratory in secondary school level were evaluated by employing a convergent parallel mixed method design. Therefore, the data gathered through questionnaires were answered quantitatively while the data collected through interview from Secondary School principals and Supervisors, document analysis and observations that conducted by the researcher were answered qualitatively.

3.5. Sources of Data

In conducting a research, there should be source of data from which data are to be secured. Hence, for the purpose of this study, the researcher used both primary and secondary data sources to get sufficient information.

3.5.1. Primary Sources of Data

For the purpose of this study the primary data sources used was science teachers, Secondary School principals, Secondary School Supervisors and grade 9^{th} and 10^{th} students from whom the data directly collected using questionnaires and interview.

3.5.2. Secondary Sources of Data

Secondary source of data are the sources of data from which the researcher gathered information indirectly to develop the information collected from primary sources of data. Hence, the researcher used science laboratory annual plans prepared by science teachers, class schedules/time table for laboratory activities, laboratory manuals, laboratory safety rules, laboratory activity reporting formats and Schools annual or half year written laboratory reports as secondary sources of data for this study.

3.6. Population and Sampling

3.6.1. Population

Population according to Kothari (2004) is all the items under thought in any field of investigation. The target population of the study covers, 81Science teachers, 19 School principals, 7 supervisors and 383Students . As a result, the target population of this study was 490.

3.6.2. Sample Size and Sampling Techniques

There are 8 town and 6 rural woreda education offices in Oromia special zone surrounding Finfine. By employing purposive sampling technique, out of six rural woreda and eight town administration education offices, the researcher selected three woreda and four town education offices that accounts for 50% of the total woredas/towns having secondary schools in the zone from four directions of Finfine City. In order to gain insight in to the problems in the implementation of science Laboratory activities the researcher also selected one governmental secondary school from each selected town /woreda totally 7 secodary schools by using simple random sampling method. These seven selected secondary Schools were namely Oda Nabe secondary school from Dukam administrative town, Holeta secondary school from Holeta

administrative town, Sululta secondary school from Sululta administrative town, Wato secondary school from Sebeta administrative town, Kolobo secondary school from Welmera woreda administration, Chancho Aba Gada secondary school from Sululta woreda administration and Tafki secondary school from Sebeta Hawas woreda administration. In all sample secondary schools, three science subjects (Biology, Chemistry and physics) were considered. The researcher used both probability and non probability sampling techniques in selecting the samples. Accordingly, the researcher took all three sciences teachers including department heads, all school principals and vice principals and all supervisors by using census or parametric method in order to get full information.

Yamane (1967) suggested a simplified formula for calculation of sample size from a population which is for a 95% confidence level with ±5% (0.05) precision, size of the sample should be:

$$\mathbf{n= N/1+N\ (e^2)}$$

Where n is sample size, N is the population size and ***e*** is the level of precision. Accordingly using this formula, from the entire population of 8835 students' 383 samples was selected by using simple random sampling technique.

Table : List of Population and Samples in Selected secondary schools

No	Name of Secondary Schools	Teachers			Principals& vice Principals			Supervisors			Students		Total participants
		P	S	%	P	S	%	P	S	%	P	S	
1	Oda Nabe Secondary School	16	16	100	3	3	100	1	1	100	1753	76	96
2	Holeta Secondary School	15	15	100	3	3	100	1	1	100	1709	74	93
3	Sululta Secondary School	13	13	100	3	3	100	1	1	100	1670	72	89
4	Wato Secondary School	11	11	100	3	3	100	1	1	100	1090	48	63
5	Kolobo Secondary School	6	6	100	2	2	100	1	1	100	615	27	36
6	Chancho Aba Gada Secondary School	14	14	100	3	3	100	1	1	100	1230	53	71
7	Tafki Secondary School	6	6	100	2	2	100	1	1	100	768	33	42
	Total	81	81	100	19	19	100	7	7	100	8835	383	490

3.7. Data Collecting Instruments and Procedures

3.7.1. Data Collecting Instruments

In conducting a research, different data collecting instruments were used to collect relevant information or data for the study. With the intention of maximizing the quality of the data, the researcher used different approaches in the data collection process. Hence, different kinds of data collection instruments which are questionnaires, semi-structured interviews, observations and document analyses were combined to capture genuine and exhaustive data. The researcher used English language for the preparation of data collection tools because, it is a medium of instructions in secondary school levels.

3.7.1.1. Questionnaires

Koul (1996) suggest that questionnaires are widely used in educational research to obtain information about certain conditions and practices and to inquire into opinions and attitudes of individuals and groups. The questionnaires for this study included both closed and open ended items which were administered for Science teachers, School principals, and students. The questionnaires were prepared in English language that have two parts in which the First section contains the general information of the respondents and the next part were about the main issues of the study.

3.7.1.2. Interview

Semi-structured interview questions were designed to gather data from school principals and Supervisors. The selection basis their position to effectively describe the reality in the study area and they have detailed information about the practices and challenges of the implementation of science laboratory activities in secondary schools. The interview guide question prepared for respondents have one part which was targeted to obtain information related to the basic research questions. Finally, interview notes were taken and summarized.

3.7.1.3. Observation

Observation was conducted by the researcher using observation checklists to identify to what extent the laboratory technicians conduct laboratory activities by engaging students actively in

the science laboratory and check the availabilities of Syllabus, Teachers guide, Laboratory Manuals, Laboratory Work sheets, Laboratory equipments and chemicals according to the standard set down.

3.7.1.4. Document Analysis

In document analysis, the researcher analyzed the science laboratory annual plans, class schedules/time table for laboratory activities, laboratory manuals, laboratory safety rules, laboratory reporting formats and written lab. reports to identify to what extent attention have been given by the school managements.

3.7.2. Procedure of Data Collection

To answer the basic research question raised, the researcher gone through series of data gathering procedures. The data was gathered from school principals, science teachers and students by using questionnaire because the advantage of using questionnaire helped to meet many respondents at the same time. Data was also gathered in the form of interview from school principals and supervisors in order to get detailed information about the practices and challenges of the implementation of science laboratory activities in the study area. In addition to these, observation and document analysis was made by the researcher for further investigation of information about the study. In doing so, having letter of authorization from Jimma University and concerned town/woreda administrative education offices for getting permission, the researcher directly gone to sample secondary schools for consent. After making agreement with the concerned participants, the researcher introduced objective and purposes of the study. Then the questionnaires were administered to sample teachers, school principals and students within taken secondary schools. The participants also showed willingness to give their own answers to each item independently as needed by the researcher. They were closely assisted and supervised by the researcher himself. Finally, the questionnaires were collected back at the right appointment.

3.8. Methods of Data Analysis

The data gathered through questionnaires, interviews, observation and document analysis were structured, organized and formed to make easy for analysis. Quantitative data analysis used for

the data gained through questionnaires from teachers, school principals, and students were organized, tabulated and described quantitatively, using frequency and percentage. To analysis the data SPSS version 22 software was used. The results of observation, interview and document analysis conducted by the researcher were organized and narrated in words.

3.9. Validity and Reliability of the study

Validity and reliability of the study are crucial in all social research regardless of disciplines and methods employed. Collected data must be accurate, authentic and representative of reality. Regardless of the form research takes or the end to which it is directed, researchers want research to be valid (Mazibuko, 2003).

3.9.1. Validity

According to Johnson and Christensen (2011), qualitative research validity refers to qualitative research that is plausible, credible, trustworthy and therefore defensible. McMillan and Schumacher (2010) describe validity of qualitative designs as the degree to which the interpretations and concepts have mutual meaning for the participants and the researcher; the researcher and the participants should agree on the descriptions and meanings of different events.

On the other hand,Validity is the significance of data that needs to be accurate enough to meet research objectives. It refers to how well the data measure what they are supposed to measure (Denscombe, 2010). Based on this, the researcher has carefully designed the questionnaires and provided to advisor, for co-advisor and OSZSF ZEO experts to check as it meet research objectives. Furthermore, each item and its instruction were written clearly and the researcher took enough time to collect data with a followed observations and interviews so as to collect rich and valid data. This was helped the respondents to understand the questions easily to give truthful information.

3.9.2. Reliability

Reliability in qualitative research refers to the consistency of the researcher's interactive style, data recording, data analysis and interpretation of participant meanings from the data (McMillan & Schumacher, 2010). Creswell (2012) asserts that using a combination of data types increase

reliability and validity as the strengths of one approach can compensate for the weakness of another approach. Accordingly, the researcher was attempted to use of multiple data types. Therefore using both closed and open ended questionnaires followed with semi structured interview, document analysis and observation methods and repeat the same questions and procedures for respondents of different schools were an evident for the reliability of this study.

3.1o. Ethical Consideration

To make the research process professional, ethical consideration were made. The researcher informed the respondents about the purpose of the study i.e. purely for academic; the purpose of the study was also introduced in the introduction part of the questionnaires and interview guide to the respondents and confirmed that respondents' confidentiality was protected. In addition to this, they were informed that their participation in the study was based on their consent. The research was not personalized any of the respondent’s response during data presentations, analysis and interpretation. Furthermore, all the materials used for this research were acknowledged.

CHAPTER FOUR: DATA PRESENTATION, ANALYSISS AND INTERPRETATION

This chapter focused on data presentation, analysis and interpretation related to the implementation status of science laboratory activities, the presence of trained laboratory technicians, factors that affect the implementation of science laboratory activity and solutions that suggested for the problems of the study. The raw data were collected, organized and tabulated based on the research questions with their common characteristics under research objectives. In addition, the demographic characteristics of respondents were included.

4.1. Demographic Characteristics of the Respondents

The respondents of the study were School principals, vice principals, Science teachers, students and Secondary School supervisors. Five relevant demographic variables of questionnaires for respondents were gathered as background information for this study. It included sex, age, level of education, overall work experiences and experiences in the school they were working. The data collection instruments used was questionnaire, interview, document analysis and observation in this study. A total of 483 copies of the questionnaire were distributed to the respondents. Out of these questionnaires, 81 copies were distributed among teachers, 19 were distributed to school Principals and vice principals and 383 copies were distributed to students among the seven sample secondary schools. From all the distributed copies of the questionnaires 480 (99.38%) were filled in and turned back on time. Interviews were also conducted with key informants (Principals and supervisors) as an additional input for the study since they have direct contact with the teaching -learning process. Accordingly, the demographic characteristics of respondents was summarized as shown in table 2 below, most of the teachers and school principals have experience in their work and majority of them have a qualification of B.Ed/Sc.

Table : General characteristic (demography) of the respondents

SN	Item	Response	School Principals		Science teachers		Supervisors		Students		Total	
			f	%	F	%	f	%	F	%	f	%
1	Sex	Male	15	78.9	62	79.5	6	85.7	224	58.5	307	63.1
		Female	4	21.1	16	20.5	1	14.3	159	41.5	180	36.9
2	Age	15-17	-	-	-	-	-	-	297	77.5	297	77.5
		18-19	-	-	-	-	-	-	81	21.1	81	21.1
		20-25	--	-	4	5.1	-	-	5	1.3	9	1.9
		26-30	1	5.3	27	34.6	-	-	-	-	28	28.9
		31-35	8	42.1	28	35.9	-	-	-	-	36	37.1
		36-40	7	36.8	13	16.7	1	14.3	-	-	21	20.2
		41-45	1	5.3	3	3.8	4	57.1	-	-	8	7.7
		46-50	2	10.5	3	3.8	2	28.6	-	-	7	6.7
3	Level of education	Grade 9	-	-	-	-	-	-	209	54.6	209	54.6
		Grade 10	-	-	-	-	-	-	174	45.4	174	45.4
		Diploma	-	-	2	2.6			-	-	2	2.6
		Degree	7	36.8	71	91.0	2	28.6	-	-	80	76.9
		Masters	12	63.2	5	6.4	5	71.4	-	-	24	23.1
4	Overall service years in teaching	1-5	-	-	24	30.8	-	-	-	-	24	30.8
		6-10	3	15.8	18	23.1	-	-	-	-	21	21.6
		11-15	13	68.4	23	29.5	-	-	-	-	36	37.1
		16-20	2	10.5	6	7.7	4	57.1	-	-	12	11.3
		21-25	1	5.3	2	2.6	2	28.6	-	-	5	4.8
		26-30	-	-	1	1.3	1	14.3	-	-	2	2.4
		31-35	-	-	2	2.6	-	-	-	-	2	2.6
		36-40	-	-	1	1.3	-	-	-	-	1	1.3
		41-45	-	-	1	1.3	-	-	-	-	1	1.3
5	Service year in this school	1-5	7	36.8	41	52.6	6	85.7	-	-	54	51.9
		6-10	9	47.4	28	35.9	1	14.3	-	-	38	36.5
		11-15	3	15.8	7	9.0	-	-	-	-	10	10.3
		16-20	-	-	2	2.6	-	-	-	-	2	2.6

Figure sources: Research Data (2019)

Key: f **=frequency**

As indicated in Table , from 487 total respondents 307(63.1%) were male wereas 180(36.9%) of them was female.

Regarding the age interval of the respondents, 297(77.%) of students were in between the age interval of 15-17 years where as 81(21.1%) of them were between 18-19 years old from the total of 383 student respondents. In the other hand, 9(1.9%) were from 20-25 years old from 461 teacher and student respondents. Similarly,28(28.9%) and 36(37.1%) from the total sum of 97 School principals and Science Teaches were 26-30 and 31-35 of age intervals respectively.On the other hand, from the total sum of 104 School principals, Science Teaches and Supervisors, 21(20.2%), 8(7.7%) and 7(6.7%) of them were in between the age of 36-40, 41-45 and 46-50 respectively.

Concerning the respondents level of education, while 209(54.6%) of students were grade 9, 174(45.4%) of them were grade 10. In the same way, when only 2(%)of teachers were diploma in qualification, 80(76.9%) and 24(23.1%) of School principals, Science teachers and supervisors have 1^{st} and 2^{nd} degree respectively that indicates majority of them have the minimum qualification requirements as the standard of secondary School.

As indicated in the same table above,24(23.1%), 21(21.6%) and 36(37.1%) of the School Principals and Science teachers have 1-5, 6-10 and 11-15 total service year respectively. On the other hand, 12(11.3%), 5(4.8%) and 5(4.8%) of the School Principals, Science teachers and supervisors have the total service in teaching 16-20, 21-25 and 26-45 respectively.

Lastly, concerning the service of respondents in the School where they asked to gave response, 54(51.9%) have 1-5 years, 38(36.5%) have 6-10 service years, 10(10.3%) and 2(2.6%) of the have 11-15 and 16-20 service years respectively.

4.2. The implementation status of laboratory activities in secondary schools under the Study

This section deals with the analysis of an assessment on the presence or absence of a separate room for biology, chemistry and physics laboratory works, the extent of science laboratory buildings and furniture's quality, the status of laboratory whether it is well equipped with chemicals, apparatus and reagents as cited in the students' text book or not and the time schedule When lab. Session carried out in the study area.

Table 3: Implementation status of laboratory activities

S.N	Item	Response	School Principals		Science teachers		Students	
			f	%	f	%	f	%
1	Is there a separate room for biology, chemistry and physics laboratory works in your school?	Yes	3	15.8	8	10.3	97	25.3
		No	16	84.2	70	89.7	286	74.7
2	To what extent your school science laboratory buildings and furniture has quality	very good	1	5.3	6	7.7	-	-
		Good	2	10.5	7	8.9	-	-
		un satisfactory	7	36.8	24	30.8	-	-
		Poor	9	47.4	41	52.6	-	-
3	Does your school science laboratory well equipped with chemicals, apparatus and reagents as cited in the student text book?	Yes	4	21.1	13	16.7	37	9.7
		No	15	78.9	65	83.3	346	90.3
4	When is lab session carried out in your school?	In its regular period (class)	3	15.8	13	16.7	66	17.2
		In opposite shift as make up class	4	21.1	12	15.4	87	22.7
		Has no regular schedule	12	63.2	53	67.9	230	60.1

Figure Sources: Own survey, September (2019) **Key: f=frequency**

As indicated in table 3, item 1, the data showed that 3 (15.8%) of School Principals, 8 (10.3%) of teachers and 97 (25.3%) of students responded that as there were separate laboratory rooms for Biology, chemistry and Physics laboratory activities. To the contrary 16 (84.2%) of School Principals, 70 (89.7%) of teachers and 286 (74.7%) of students responded that their schools have no separate rooms for biology, chemistry and physics laboratory works and the departments share common room to carry out laboratory activities. So, from the data analyzed in table 3 above, there is no significance difference among School Principals, teachers and students' responses regarding the presence or absence of separated laboratory rooms for laboratory activities of each science subjects. Besides, the observation result conducted by the researcher also confirmed the absence of separate laboratory rooms for three science subjects in majority of the schools of the study area and different departments used the common laboratory rooms for

practice whereas there were no totally laboratory rooms in some schools. So, it was too hard to perform laboratory activities in those schools.

Teachers perform practical and demonstrations when the school has laboratories, equipments, chemicals and reagents (Wiley, 2000). If the laboratories, equipments, chemicals and reagents are not present, science teacher prefer lecture methods. Therefore, it is clear that the implementation status of laboratory activities was at very low level in the schools under the study area.

As shown in table 3 item 2 above, concerning the extent of quality of their school laboratory building and furniture,1 (5.3%) of principals and 6 (7.7%) of teacher respondents rated as very good. On the other hand, 2(10.5%) of principals and 7(8.9%) of teachers responded as good whereas 7(36.8%) of school principals and 24 (30.8%) of teachers ranked the quality of their laboratory buildings and furniture's as unsatisfactory. Lastly, 9(47.4%) of principals and 41 (52.6%) of science teachers replied as it was poor in quality.

As school principals replied through interview questions, majority of them responded that the quality of their laboratory buildings and furniture's were poor and in some schools since there were totally no laboratory buildings, school principals said ***"it is** difficult to discuss about this*". Particularly principal of school"X" responded for this question by saying "*asking the quality of laboratory buildings and furniture is just similar with that of sayings 'searching Manure from where Cows didn't stayed' or "ላም ካልዋለበት ኩበት ለቀማ"* to show to what extent their school laboratory buildings and furniture was poor.

Therefore, the interview and observation results confirmed that there were poor standards and design of laboratory buildings and furniture in the schools of study area. Moreover the responses from interview *added that the existence of one common laboratory room for all sections (grade 9-10 in most schools) 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. Furthermore; the observation result indicated that laboratory furniture such as tables, cabinets, shelves, sinks, etc. were absent totally in some schools and not properly setup in other secondary schools of the study area.* This suggests that secondary school laboratories under investigation are not at good status and not up to standard to support students' meaningful learning. Therefore, the result was agreed with Hunde and Tegenge (2010) which reported that,

despite the fact that laboratories have multiple benefits ranging from making learning concrete to lying basis for science education; students were deprived of such opportunities.

Regarding whether the school science laboratories were well equipped with chemicals, apparatus and reagents as cited in the student's text books or not, most of the respondents gave similar response. As table 3, item 3 showed, 4 (21.1%) of principals, 13(16.7%) of teachers and 37 (9.7%) of students responded that their school laboratories were well equipped with chemicals, apparatus and reagents according to it cited in the student's text books. On the contrary 15(78.9%) of school principals, 65(83.3%) of science teachers and 346 (90.3%) of students replied that their school laboratories were not well equipped with chemicals, apparatus and reagents as needed.

Similarly, the interview result from school principals indicated that, there were lack of adequate equipments, apparatus, chemicals and reagents in the study area. As a result, most of the time their school laboratories are non-functional. So, theoretical knowledge of science is not supported by practical activities in these schools and this makes science learning incomplete and students could not get practical skill and experience which is a big educational concern in science to determine their destination. Therefore, one of the constraints for implementation of science laboratory activities is lack of sufficient laboratory equipments and materials in the study schools. In this regard the present study finding tended to conflict with the idea of Farombi (1998) in Yara (2010) that argued "seeing is believing" is the effect of using laboratories in the teaching and learning of science and other science related disciplines as students tend to understand and recall what they see more than what they hear. Therefore; improving school laboratories is improving the quality of education in science. Generally , the mplementation status of science laboratory activities in secondary schools of the study area was in serious problems and need immediate remedial actions by concerned bodies or stakeholders as much as possible.

Concerning whether there was regular arranged time schedule or not for laboratory activities in secondary schools, the respondents were asked and interviewed. As shown in the table 3, item 4 above, most of the respondents 12(63.1%) of principals, 53(67.9%) of science teachers and 230 (60.1%) of students responded that the laboratory activities has no regular schedule at all in most of the study schools. On the other hand, 3(15.8%) of principals, 13(16.7%) of teachers and

66 (17.2%) of students replied that as laboratory activities performed in its regular period (class) whereas 4(21.1%) of principals, 12(15.4%) of teachers and 87 (22.7%) of students responded as it performed in opposite shift as make up class.

The result of document analysis performed by the researcher also confirmed the same things with the result obtained through questionnaires and interview of different respondents which indicated that totally the absence of laboratory activity time schedule, no laboratory activity reporting formats, no laboratory activity annual plans prepared by science teachers, lack of sufficient laboratory manuals and the school annual or half year report prepared by school directors was not sound enough to show the implementation status of science laboratory activities. Generally, the implementation of science laboratory activity of the schools under the study area didn't get considerable attention by concerned bodies. Therefore, all stakeholders responsible to bring the quality of education particularly in science to meet the policy of 70:30 professional mix in our county that demonstrated the government has given due attention to science education (Tesfaye et al., 2010).

As the interview results obtained from secondary school supervisors indicated …

> *the extent to what laboratory activities performed in their schools were very low and the reason why laboratory activities were not performed as the normal schedule was due to: large class size, over crowdedness of the periods, lack of sufficient time(regular schedue) for the laboratory activity, lack of enough laboratory rooms, lack of laboratory technicians and lack of enough Laboratory Manuals and safety materials to conduct different laboratories at one time in different sections.*

Therefore, from the above different respondents result collected and analyzed through different data gathering instruments, one can understand that there was no regular time schedule for laboratory activities as cited in the student's text books and that was negatively impacted its' implementation in the study area. Hence the chance of secondary school students of the study area to perform laboratory activities was very low and mostly they learn theoretically which was tend to conflict with Hofstein (2004), a practical activity in science education is an activity used to engage students in investigation, discoveries, inquiries and problem solving activities and is the center of science teaching and learning.

4.3. Laboratory technicians and related cases

This section presents about an assessment related to the presence or absence of laboratory technicians for science subjects, to what extent they perform laboratory activities for each science subjects according to the activities given in students' text books, the degree of respondents' satisfaction on the laboratory activities performed in their schools and the presence or absence of regular training on laboratory activities for Laboratory technicians and science teachers at secondary schools the study area.

Table 4: The presence of trained laboratory technicians and related cases

S.N	Item	Response	School Principals		Science teachers		Students	
			f	%	f	%	F	%
1	Are there laboratory technicians for biology, physics and chemistry separately in your School?	Yes	1	5.3	4	5.1	13	3.4
		No	18	94.7	74	94.9	370	96.6
2	To what extent they perform laboratory activities for each subjects according to the activities given in students' text books	Always	4	21.1	8	10.3	-	-
		Sometimes	12	63.2	48	61.5	--	-
		not at all	3	15.8	22	28.2	-	-
3	What are the reasons for not having laboratory technicians?	Lack of trained laboratory technicians	12	63.2	31	39.7	-	-
		lack of budget	4	21.1	24	30.8	-	-
		Unwillingness of education units to recruit laboratory technicians	3	15.8	23	29.5	-	-

The result on table 4 item 1 showed that 94.9% of teachers, 94.7% of school principals and 96.6% of students confirmed that there were no trained laboratory technicians in their schools at all whereas only about 5.1% of teachers, 5.3% of school principals and 3,4% of students respectively indicated that they have trained laboratory technicians. This shows that most of the secondary schools in the study area did not have laboratory technicians. But the presence of well trained laboratory technicians is very important for the implementation of laboratory activity and its material managements and safety because within the laboratory, there are hazardous chemicals, flammable liquid and etc to be controlled by them.

The result from interview of secondary school supervisors also indicated that it is hard to find qualified and experienced laboratory technicians in the majority of secondary schools of the study area. But as an interview respondents replied, “If there are laboratory technicians in schools they have diverse and demanding roles to implement science lab. activities that include preparing resources for and giving technical support for science teachers in teaching of science practical work in their schools and have significant responsibilities for health and safety, first aid and training.”

As table 4 item 2 above indicated, 21.1% of principals and 10.3% of teachers responded that the extent to what laboratory activities performed in their schools according to the activities given in the students text book is always whereas **63.2**% and 61.5% and 15.8% and 28.2% of principals and teachers revealed that it is performed sometimes and not at all in their schools respectively. Therefore, laboratory activities didn't supported by laboratory technicians in secondary schools of the study area due to the lack of laboratory technicians and which is agreed with (Jonassen, 1991) that suggested "If there is no practice either individually or in a group all what have been learnt become inert knowledge.

The same table item 3 above indicated that, 63.2% of principals and 39.7% of teachers mentioned that the major reason for having no laboratory technicians in secondary schools was lack of trained laboratory technicians in the market. On the other hand, 21.1% of school principals and 30.8% of teachers responded its case as a budget constraint while 15.8% of principals and 29.5% of teachers responded that unwillingness of schools/education units to recruit laboratory technicians as reason for having no technician. Therefore, from the result of analysis in table 4, one can understand that even though the major reason for having no technicians in secondary schools of the study area was lack of trained laboratory technicians in the market, unwillingness and less attention of education units to recruit the available laboratory technicians can also considered as second reason for the absence of technicians in the school. This leads the laboratory work to be done by untrained teachers meaning that those teachers having no enough training and experiences in laboratory activities.

Table 5: Training given for lab. Technicians, teachers and satisfaction on their performance

S.N	Item	Response	School Principals		Science teachers		Students	
			F	%	f	%	F	%
1	Do Laboratory technicians and teachers get regular training on laboratory activities to competently perform a number of tasks related to laboratory practices?	Yes	2	10.5	5	6.4	-	-
		No	17	89.5	73	93.6	-	-
2	To what extent you are satisfied on the laboratory activities doing in your school?	very high	-	-	8	10.3	30	7.8
		High	3	15.8	2	2.6	24	6.3
		medium	4	21.1	12	15.4	39	10.2
		Low	1	5.3	11	14.1	160	41.8
		very low	11	57.9	45	57.7	130	33.9

Figure Sources: Own survey, August (2019) **Key: f=frequency**

The result on Table 5 Item 1 showed that only small 2(10.5%) of principals and 5(6.4%) of teachers responded as science teachers and laboratory technicians have got regular training on laboratory activities to competently perform a number of tasks related to laboratory practices whereas 17(89.5%) of principals and 73(93.6%) of teachers replied that laboratory technicians and teachers did not get regular training in laboratory rules and regulations in secondary schools of Oromia special Zone surrounding Finfine. They were in need of further support or training to competently perform a number of tasks related to laboratory practices. Laboratory work is the task to be carried out by someone who is experienced with the activities. Research in Ethiopia indicated that students have serious knowledge deficits in science and mathematics; this signifies

that the quality of science education in primary and secondary schools, which is critical foundations for latter educational development, is at crisis (FSS, 2009).

However, the Ethiopian Government has recently introduce policy of 70:30 percent professional mix in annual enrolment, with 70% of intakes allocated in to science and technology streams and 30% in to the social science and humanity steams. The rationale behind this initiative is the belief that science and technology are the engines of development and that Ethiopia's prospect hinges on the availability of sufficient stock of national expertise in these fields by its higher institutions (Tesfaye et al., 2010). Therefore, to equip the future 70% science enrolling Students with practical activities are mandatory to meet the countries goals.

School principals and Teacher respondents were asked about how far they were satisfied on the laboratory activities of their schools. As shown in Table 5, item 2 above, the result indicated that no school principals and 10.3% of teaches replied as they was satisfied very high, 21.1% of principals and 15.4% of teaches as medium, 5.3% of principals and 14.1% of teachers as low satisfaction whereas most of the respondents i.e. 57.9% of school principals and 57.7% of teacher's satisfaction was very low. From this it is possible to conclude that the extent to which the implementation of science laboratory activities in secondary schools of the study area is very low.

The National Science Education Standards clearly presented a vision for quality teaching and learning of science that includes: students' understanding of science is achieved through their engagement and active construction and teachers' understanding of and relationship with their students have a great influence on their actions.

4.4. Factors that affect the implementation of laboratory activities

This part presents the views of school principals and science teacher's responses on the factors that affect laboratory activities according to their rank of severity in affecting the implementation of science laboratory activities in secondary schools of Oromia special Zone surrounding Finfine. Hence, the following items have been identified in the study and the responses of school principals and science teachers were presented, analyzed and interpreted as follows.

Table 6: Factors that affect the implementation of laboratory activities

Items	Descriptions	School Principals			Science teachers			Students		
		F	%	Rank	f	%	Rank	F	%	Rank
1	Absence of separate Laboratory rooms for Biology, chemistry and physics	13	68.4	2nd	53	67.9	1st	257	67.1	2nd
2	Lack of enough Laboratory technicians	14	73.7	1st	49	62.8	2nd	341	89.0	1st
3	Absence of reward	7	36.8	4th	25	32.1	4th	122	31.9	6th
4	Lack of appropriate laboratory schedule	9	47.4	3rd	27	34.6	3rd	222	58.0	3rd
5	Lack of adequate Laboratory equipment, chemicals and materials	6	31.6	5th	27	34.6	3rd	160	41.8	1st
6	Lack of teachers commitment	5	26.3	6th	22	28.2	6th	118	30.8	7th
7	Lack of students interest	5	26.3	6th	24	30.8	5th	158	41.3	4th
8	Teachers lack of training	7	36.8	4th	19	24.4	7th	132	34.5	5th

*Respondents gave more than one response

Figure Sources: Own survey, August (2019) **Key: f=frequency**

As shown in table 6, item 1, about the absence of separate Laboratory rooms for Biology, chemistry, 67.9% of science teachers rated as the 1st whereas 68.4% of School Principals and 67.1 % of students ranked as the 2nd in severity as factors that affect laboratory activities in secondary schools of the study area. In the same table, item 2 concerning the lack of enough laboratory technicians, 73.7% of school principals and 89.0% of students rated as the 1st and 62.8% of science teachers ranked it as the 2nd factor in affecting the implementation of science laboratory activities.

In regard to absence of reward as a factor that affect the implementation of science laboratory activity in the study area , when 36.8% of school principals and 32.1% of science teachers ranked it as the 4th, 31.9% of students ranked as the 6th . This implies that this concern is a medium in severity in affecting the implementation of the activity in particular study area.

Lack of appropriate laboratory schedule rated as the 3rd major factor by all types of respondents' i.e. 47.4% of school principals, 34.6% of science teachers and 58% of students respectively. This indicated that absence of appropriate laboratory schedule is the common factor that affects the implementation of lab. activity in the study area. Concerning the Lack of

adequate Laboratory equipment, chemicals and materials, respondents ranked it differently i.e. 31.6% of principals rated as 5th, 34.6% of teachers ranked as 3rd and 41.8% students ranked it as the 1st major actors in affecting the implementation of the activity.

Lack of teachers' commitment, students' lack of interest and lack of teachers training were ranked as 4th and above by all types of respondents. From this one can understand that if other facilities are full filled in the school, especially most of the students have an interest to participate in performing practical activities.

Moreover, in responding to interview and open-ended questions, as replied by secondary school principals and supervisors, there were a number of problems that encountered in practical activities. The major once were lack of appropriate tables and chairs in the laboratory rooms, the large number of students per class and section, the accumulation of outdated or expired laboratory chemicals in lab. rooms due to the absence of trained laboratory technicians and lack of attention with concerned bodies to remove these expired chemicals and replace it with the updated one, the lack of enough water supply, the problem of electric power discontinuity and totally the absence of electric installation in some schools were additional factors that hinder the activities of science laboratory.Therefore, it was agreed with (Dahar, 2011) that stated the facilities for teaching science are not up to the standard at secondary and higher secondary school stages.

Even though, learning by doing is the most appropriate for students to understand, in many secondary schools of Oromia special Zone surrounding Finfine, this part was not treated in appropriate manner.

4.4.1.Cumulative Average ranks of factors that affect the implementation of Science Laboratory Activity

The ranks of factors that affect the implementation of science laboratory activities at secondary schools of the study area mentioned under 4.4 subsection in table 6 was ranked vertically depended upon the responses replied by different respondents (school principals, science teachers and students) through questionnaire in which some of its' ranking made disagreement among respondents, it might made some complexity for the reader to understand it easily. To minimize this complexity and make it visible to understand easily the following table was

prepared. The cumulative percentage was calculated dividing the cumulative frequency of respondents for 480 total sum of respondents(school principals, science teachers and students) asked to reply through questionnaires.

Table 7: Cumulative Average ranks of factors that affect the implementation of Science Laboratory Activity

S, N	Descriptions	Cumulative frequency (f)	Cummulative %	Rank
1	Absence of separate Laboratory rooms for Biology, chemistry and physics	323	67.3	2nd
2	Lack of enough Laboratory technicians	404	84.2	1st
3	Absence of reward	154	32.1	7th
4	Lack of appropriate laboratory schedule	258	53.8	3rd
5	Lack of adequate Laboratory equipment, chemicals and materials	193	40.2	4th
6	Lack of teachers commitment	145	30.2	8th
7	Lack of students interest	187	38.9	5th
8	Teachers lack of training	158	32.9	6th

Figure Sources: Own survey, August (2019) **Key: f=frequency**

As shown in table 7, according to the cumulative average of all respondents, factors that affect the implementation of science laboratory activities in secondary schools of the study area was ranked as Lack of enough Laboratory technicians, Absence of separate Laboratory rooms for Biology, chemistry and physics, Lack of appropriate laboratory schedule, Lack of adequate Laboratory equipment, chemicals and materials , Lack of students interest, Teachers lack of training, Absence of reward and Lack of teachers commitment respectively in their descending order based on their severity level.

4.5. Suggested solutions to the problems

This part presents the views of respondent's responses on Suggested solutions and the rank of priority to solve the factors that affect the implementation of science laboratory activities in the secondary schools of Oromia special Zone surrounding Finfine. Hence, the following items have been identified in the study and the responses of school principals, science teachers and students were presented, analyzed and interpreted as below.

Table 8: Suggested solutions to the problems in their priority

S. N	Descriptions	School Principals			Science teachers			Students		
		F	%	Rank	F	%	Rank	f	%	Rank
1	Employment of trained Laboratory Technicians	13	68.4	1st	61	78.2	1st	337	88.0	1st
2	Training of laboratory technicians	11	57.9	2nd	51	65.4	2nd	296	77.3	*4th*
3	Awareness training for teachers, principals and supervisors on laboratory activities	8	42.1	*4th*	28	35.9	5th	189	49.3	5th
4	Material support (furniture, chemicals, reagents)	9	47.4	3rd	29	37.2	*4th*	176	46.0	5th
5	Preparing schedule for laboratory activities per week	7	36.8	5th	28	35.9	5th	301	78.6	3rd
6	Setting up a well-equipped laboratory	9	47.4	3rd	48	61.5	3rd	328	85.6	2nd

*Respondents gave more than one response

Figure Sources: Own survey, August (2019) **Key: f=frequency**

Respondents were asked to rank the possible solutions to the problems of laboratory activities in secondary schools of Oromia special Zone surrounding Finfine. Table 8 above shows the numbers and percentages of the respondents suggesting each type of solutions.

AS table 8, item 1 showed all types of respondents ranked the employment of trained laboratory technicians as the 1st priority to solve the problems of implementing science laboratory activities in the study area by 68.4% of school principals, 78.2% of science teachers and 88% of students respectively.

In the same table item 2 (training of laboratory technicians) ranked as the 2nd important things to solve laboratory related problems in secondary schools of the study area that was supported by 57.9% of principals and 65.4% of science teaches whereas 77.3 & of students ranked it as 4th priority to be solved. On the other hand, Awareness training for teachers, principals and supervisors on laboratory activities were also mentioned as the 4th by 42.1% of school principals and 5th important things to solve laboratory related problems by 35.9% of science teachers and 49.3% of students. As indicated in table 8 item 4, Material support (chemicals, furniture and reagents) were ranked differently by the respondents as 3rd, 4th and 5th by 47.4% of school principals, 37.2 & of science teachers and 46% of students respectively. This indicated that the respondents have different awareness and perspectives for the given item to what extent it can affect the implementation of science laboratory activities in the study area. In the same way, while 36.8% of school principals and 35.9% of science teachers ranked item 5 of table 8(Preparing schedule for laboratory activities per week) as 5th, 78.6% of students ranked it as the 3rd important things to solve laboratory implementation related problems. Lastly, as indicate in table 8, item 6 (Setting up a well-equipped laboratory) rated as 3rd priority to be solved by 47.4% of school principals and 61.5% of science teachers whereas it was ranked as the 2nd important things by 85.6% of students.

4.5.1.Cumulative Average ranks for suggested solutions to the problems.

The ranks for suggested solutions tackle factors that affect the implementation of science laboratory activities at secondary schools of the study area mentioned under 4.5 subsection in table 8 was ranked vertically depended upon the responses replied by different respondents (school principals, science teachers and students) through questionnaire in which some of its' ranking made disagreement among respondents, it might made some complexity for the reader to understand it easily. To minimize this complexity and make it visible to understand easily the following table was prepared. The ranks mentioned in table 9 below was arranged according to their priority to take the action by concerned bodies in solving the problems that hinder the implementation of science laboratory activities in secondary schools under the study area.

Table 9 : Cumulative Average suggested Solutions to the problem

S, N	Descriptions	Cumulative frequency (f)	Cummulative %	Rank
1	Employment of trained Laboratory Technicians	411	85.6	1st
2	Training of laboratory technicians	358	74.6	3rd
3	Awareness training for teachers, principals and supervisors on laboratory activities	225	46.9	5th
4	Material support (furniture, chemicals, reagents)	214	44.6	6th
5	Preparing schedule for laboratory activities per week	336	70	4th
6	Setting up a well-equipped laboratory	385	80.2	2nd

Figure Sources: Own survey, August (2019) **Key: f=frequency**

NB. The sum total of respondents(School principals, Science teachers and Students)= 480.

In general, from the average of analysis indicated in table 9 above, one can understand that the suggested solutions can be prioritized as " Employment of trained Laboratory Technicians, Setting up a well-equipped laboratory, Training of laboratory technicians, Preparing schedule for laboratory activities per week, Awareness training for teachers, principals and supervisors on laboratory activities and Material support (furniture, chemicals, reagents)" respectively in ascending order of their priority to solved.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This final chapter presents summary of major findings, conclusions drawn from findings, and recommendations forwarded on the basis of the finding of the study that researcher suggested to encourage the implementation of science laboratory activities in secondary school of Oromia Special Zone Surrounding Finfine. The main objective of this study was to assess the implementation of science laboratory activities at secondary schools of Oromia Special Zone Surrounding Finfine. Based on data analyzed, major findings were summarized in response to objectives raised as follows.

5.2. Summary of Major Findings

The purpose of this study was to assess the implementation of science laboratory activities in government secondary schools of Oromia Special Zone Surrounding Finfine. Even though laboratory activity expected to create, develop and strengthen students' practical knowledge of science, the major finding of this study indicated that the implementation of secondary school science laboratory activity in OSZSF were not effective enough in improving teaching learning science. These major findings of the study are mentioned as follows.

- In the current study, for each science subjects, almost all secondary schools have no separate laboratory rooms whereas there is no totally laboratory rooms in some schools and laboratory chemicals, apparatus and equipments are simply stored in non-ventilated laboratory room and are no functional.

- Most of the respondents notified that school science laboratories were not well equipped with chemicals, apparatus and reagents as cited in the students' text books.

- Most of the respondents (greater than 90%) indicated almost all secondary schools of the study area have no separate trained laboratory technicians for science subjects to handle the laboratory activities due the absence of trained human resource and budget constraints. As a result laboratory activities were not functionally implemented in the schools.

- As confirmed by greater than 80% of the respondents, there is no regular arranged time schedule for laboratory activities in secondary schools of the study area.
- The role of laboratory technicians were unsatisfactory and did not responding to implement science laboratory activities in the study area **.**

5.3. Conclusions

An attempt had been made to assess the implementation of secondary school science laboratory activities in relation to separate laboratory rooms, laboratory chemicals and equipments, laboratory technicians, factors affecting the implementation of laboratory activity and solutions to the problems related to the activity. Basically, laboratory activity is one of the most important ways of teaching and learning process which is an active and interactive method that requires students to be involved in observing or manipulating real objects and materials.

It is believed that practice is at the heart of mastery of science discipline because if there is no practice in science teaching, all what have been learnt become easily forgotten. For this reason, it was aimed to examine the implementation of science laboratory activities in improving teaching learning and quality of science education in the study area. Hence, from the findings of the study, the following conclusions were made.

There were no separate laboratory rooms for science subjects and most of the schools used common laboratory room for all science subjects and sections of grade 9 and 10 which creates an overcrowding and clashing of laboratory programs. These common laboratory rooms by them selves were not well equipped with chemicals, apparatus and reagents according to the standard and poorly arranged. On the other hand, there were totally no laboratory rooms in some schools and laboratory materials, equipments and chemicals were stored in other classes together with other teaching materials and poorly handled.

There major factors that affect the implementation of science laboratory activities in secondary schools of OSZSF were lack of enough laboratory technicians, absence of separate Laboratory rooms for Biology, chemistry and physics, lack of appropriate laboratory schedule, lack of adequate laboratory equipment, chemicals and materials , lack of students interest, Teachers lack of training, absence of reward and lack of teachers commitment respectively in their order of severity level.

- In general The implementation of Science laboratory activities in secondary schools of the study area was in a very low level where science teaching learning process was not supported adequately by laboratory activities. Therefore, unless the above factors were resolved, it is difficult to implement science laboratory activities in secondary schools of the study area accordingly in the existent state and not easy for students to acquire practical knowledge of science as well.

5.4. Recommendations

The findings of the study that have been conducted in Oromia special zone surrounding Finfine, shows that the process of teaching and learning of science with laboratory is inefficient. Importantly, considerable gaps exist between actual science teaching and learning and a realistic idea. Achieving scientific literacy for citizens therefore, requires closing the gap between actual science teaching and learning and the gap in laboratory activities by making realistic recommendations to address the limiting factors that constrain the implementation of science laboratory activities. Therefore, based on the findings of the study and conclusions drawn, the following recommendations were forwarded.

- Secondary school teachers of the study area should include a combination of lecture accompanied by practical demonstrations and range of laboratory activities in order to make science teaching practical.
- MoE, Oromia regional education Bureau as well as the Zonal education offices should facilitate training for science teachers, laboratory technicians and school principals to fill their skill gap in Laboratory activities.
- School administrators, Woreda education officers needed to motivate science teachers as well as Laboratory technicians to add their effort in laboratory activities and practices.
- MoE should give special attention in resource allocation for laboratory equipments, Laboratory class buildings and chemicals to improve laboratory activities and to meet the 70:30 science-technologies to social science proportion of Ethiopian higher education program/policy.
- Woreda's and Town's education officers should recruit laboratory technicians to alleviate the shortage of technicians that has been seen in secondary schools of the study area.

- Secondary school supervisors and principals should be expected to monitor and evaluate the practices of laboratory activities for the improvement of practical science teachings in the study area.
- School principals should set regular schedule/time table/ for the implementation of laboratory activities
- Towns and Woredas education offices should allocate enough budgets to build standardized, well equipped and separated laboratory rooms for three science subjects.

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Appendices

Appendix1. Questionnaire to be filled by Secondary School Principal.

JIMMA UNIVERSITY

College of Education and Behavioral Sciences

Department of Teacher Education and Curriculum Studies

Dear respondent, I am **Abera Wakessa Gemeda,** MA student at Jimma University in the field of Curriculum and Instruction. As part of the requirements for the master's degree at Jimma University, I am conducting a study on "**The Implementation of Science Laboratory Activities at Secondary Schools of Oromia Special Zone Surrounding Finfine**". Hence, you are kindly requested to voluntarily participate in this research endeavor by providing genuine and honest responses to the questions presented below as your responses are highly relevant for the success of the study. The information you provide will only be used strictly for academic purposes and will be kept confidential. Therefore, you are kindly requested to respond to the questions as per the instructions indicated under each part. If you have any question or comments, please feel free to contact me through my e-mail address aberawakess2016@gmail.com.

Thank you in advance for your cooperation!

AberaWakessa

Note:

- No need of writing your name.
- Make a tick mark **(√)** on
- If you change your response, please cancel the former one and show your responses on the space provided.

Part I: Background information of the respondents

1. Name of your woreda/town _____
2. Name of your school _____
3. Sex: Male ☐ Female ☐
4. Age_____
5. Level of education:- Diploma ☐ Degree ☐ Masters ☐
6. Overall service years (in teaching):- 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐
   21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐
7. Service year in this school:-1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐
   26-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐

Part II:- For each of the following questions Please give your responses by putting "√ " mark in the space/box/ provided under each questions

1. The current status of laboratory activities in secondary schools

1.1. Is there a separate room for biology, chemistry and physics laboratory works in your school?

Yes ☐ No ☐

1.2. To what extent your school science laboratory buildings and furniture has quality?

Very good ☐ good ☐ unsatisfactory ☐ poor ☐

1.3. Does your school science laboratory well equipped with chemicals, apparatus and reagents based on the student text book?

Yes ☐ No ☐

1.4. When is lab session carried out in your school?

In its arranged period ☐ in opposite shift as make up class ☐

Has no regular schedule ☐

1.5. If your answer for question "1.1" is "No": how Laboratory activities can be conducted in three science subjects? Please List the ways of implementing Laboratory activities in the absence of separate laboratory rooms for biology, chemistry and physics in your school context on the space provided below.

_____

_____

2. The presence of trained laboratory technicians in secondary schools of the study area

2.1. Are there laboratory technicians for biology, physics and chemistry separately in your School?

Yes ☐ No ☐

2.2. If your answer is "yes" for question number 2.1, to what extent they perform laboratory activities for each subjects according to the activities given in students' text books?

Always ☐ Sometimes ☐ Not at all ☐

2.3. If your answer is "No" for question number "2.1", what are the reasons for not having laboratory technicians?

Lack of trained laboratory technicians ☐ Budget constraints ☐

Unwillingness of schools/education units to recruit laboratory technicians ☐

If there are another reasons out of mentioned above, please jot down on the space provided below

_____

_____

2.4. Do Laboratory technicians and teachers get regular training on laboratory activities to competently perform a number of tasks related to laboratory practices?

Yes ☐ No ☐

2.5. To what extent do you satisfied on the laboratory activities doing in your school?

Very high ☐ high ☐ medium ☐ low ☐ very low ☐

3. Factors affecting the implementation of science laboratory activities

3.1. The following points listed in the table below are factors that can affect the implementation of laboratory activities: please try to rank them based on their severity in affecting it by putting "√" mark under the column of rank provided in the table according to the context of your school?

Items	Descriptions	Rank							
		1st	2nd	3rd	4th	5th	6th	7th	8th
1	Absence of separate Laboratory rooms for Biology, chemistry and physics								
2	Lack of enough Laboratory technicians								
3	Absence of reward								
4	Lack of appropriate laboratory schedule								
5	Lack of adequate Laboratory equipment, chemicals and materials								
6	Lack of teachers commitment								
7	Lack of students interest								
8	Teachers lack of training								

3.2. If there are another factors that can affect the implementation of science laboratory activities in your school; please list them down on the space provided bellow.

_____

_____

_____

4. Suggested solution to tackle these problems?

4.1. The following points listed in the table below are Suggested solutions to the problems(factors) affecting the implementation of Science Laboratory activities; please try to rank them based on their priority to give the solution by putting **"√ "**

mark under the column of rank provided in the table according to the context of your school?

Items	Descriptions	Rank					
		1st	2nd	3rd	4th	5th	6th
1	Employment of trained Laboratory Technicians						
2	Training of laboratory technicians						
3	Awareness training for teachers, principals and supervisors on laboratory activities						
4	Material support (furniture, chemicals, reagents)						
5	Preparing schedule for laboratory activities per week						
6	Setting up a well-equipped laboratory						

4.2. If there are another solutions to the problems (factors) affecting the implementation of science laboratory activities in your school; please list them down on the space provided bellow

Appendix2. Questionnaire to be filled by Secondary School Science Teachers

JIMMA UNIVERSITY

College of Education and Behavioral Sciences

Department of Teacher Education and Curriculum Studies

Dear respondent, I am **Abera Wakessa Gemeda,** MA student at Jimma University in the field of Curriculum and Instruction. As part of the requirements for the master's degree at Jimma University, I am conducting a study on "**The Implementation of Science Laboratory Activities at Secondary Schools of Oromia Special Zone Surrounding Finfine**". Hence, you are kindly requested to voluntarily participate in this research endeavor by providing genuine and honest responses to the questions presented below as your responses are highly relevant for the success of the study. The information you provide will only be used strictly for academic purposes and will be kept confidential. Therefore, you are kindly requested to respond to the questions as per the instructions indicated under each part. If you have any question or comments, please feel free to contact me through my e-mail address aberawakess2016@gmail.com.

Thank you in advance for your cooperation!

AberaWakessa

Note:

- No need of writing your name.
- Make a tick mark **(√)** on
- If you change your response, please cancel the former one and show your responses on the space provided.

Part I: Background information of the respondents

8. Name of your woreda/town _____
9. Name of your school _____
10. Sex: Male ☐ Female ☐
11. Age_____
12. Level of education:- Diploma ☐ Degree ☐ Masters ☐
13. Overall service years (in teaching):- 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐
14. Service year in this school:-1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐

Part II:- For each of the following questions Please give your responses by putting "√ " mark in the space/box/ provided under each questions

1. The current status of laboratory activities in secondary schools

1.1. Is there a separate room for biology, chemistry and physics laboratory works in your school?

Yes ☐ No ☐

1.2. To what extent your school science laboratory buildings and furniture has quality?

Very good ☐ good ☐ unsatisfactory ☐ poor ☐

1.3. Does your school science laboratory well equipped with chemicals, apparatus and reagents based on the student text book?

Yes ☐ No ☐

1.4. When is lab session carried out in your school?

In its arranged period ☐ in opposite shift as make up class ☐

has no regular schedule ☐

1.5. If your answer for question "1.1" is "No":how Laboratory activities can be conducted in three science subjects? Please List the ways of implementing Laboratory activities in the absence of separate laboratory rooms for biology, chemistry and physics in your school context on the space provided below.

_____

_____

2. The presence of trained laboratory technicians in secondary schools of the study area

2.1. Are there laboratory technicians for biology, physics and chemistry separately in your School?

Yes ☐ No ☐

2.2. If your answer is "yes" for question number 2.1, to what extent they perform laboratory activities for each subjects according to the activities given in students' text books?

Always ☐ Sometimes ☐ Not at all ☐

2.3. If your answer is "No" for question number "2.1", what are the reasons for not having laboratory technicians?

Lack of trained laboratory technicians ☐ Budget constraints ☐

Unwillingness of schools/education units to recruit laboratory technicians ☐

If there are another reasons out of mentioned above, please jot down on the space provided below

_____

_____

2.4. Do Laboratory technicians and teachers get regular training on laboratory activities to competently perform a number of tasks related to laboratory practices?

Yes ☐ No ☐

2.5. To what extent do you satisfied on the laboratory activities doing in your school?

Very high ☐ high ☐ medium ☐ low ☐ very low ☐

2. Factors affecting the implementation of science laboratory activities

2.2. The following points listed in the table below are factors that can affect the implementation of laboratory activities: please try to rank them based on their severity in affecting it by putting "√" mark under the column of rank provided in the table according to the context of your school?

Items	Descriptions	Rank							
		1st	2nd	3rd	4th	5th	6th	7th	8th
1	Absence of separate Laboratory rooms for Biology, chemistry and physics								
2	Lack of enough Laboratory technicians								
3	Absence of reward								
4	Lack of appropriate laboratory schedule								
5	Lack of adequate Laboratory equipment, chemicals and materials								
6	Lack of teachers commitment								
7	Lack of students interest								
8	Teachers lack of training								

2.3. If there are another factors that can affect the implementation of science laboratory activities in your school; please list them down on the space provided bellow.

_____

_____

_____

3. Suggested solution to tackle these problems?

3.1. The following points listed in the table below are Suggested solutions to the problems(factors) affecting the implementation of Science Laboratory activities; please try to rank them based on their priority to give the solution by putting **"√ "** mark under the column of rank provided in the table according to the context of your school?

Items	Descriptions	Rank					
		1st	2nd	3rd	4th	5th	6th
1	Employment of trained Laboratory Technicians						
2	Training of laboratory technicians						
3	Awareness training for teachers, principals and supervisors on laboratory activities						
4	Material support (furniture, chemicals, reagents)						
5	Preparing schedule for laboratory activities per week						
6	Setting up a well-equipped laboratory						

3.2. If there are another solutions to the problems (factors) affecting the implementation of science laboratory activities in your school; please list them down on the space provided bellow

Appendix3. Questionnaire to be filled by secondary school Students

JIMMA UNIVERSITY

College of Education and Behavioral Sciences

Department of Teacher Education and Curriculum Studies

Dear respondent, I am **Abera Wakessa Gemeda,** MA student at Jimma University in the field of Curriculum and Instruction. As part of the requirements for the master's degree at Jimma University, I am conducting a study **on "The Implementation of Science Laboratory Activities at Secondary Schools of Oromia Special Zone Surrounding Finfine"**. Hence, you are kindly requested to voluntarily participate in this research endeavor by providing genuine and honest responses to the questions presented below as your responses are highly relevant for the success of the study. The information you provide will only be used strictly for academic purposes and will be kept confidential. Therefore, you are kindly requested to respond to the questions as per the instructions indicated under each part. If you have any question or comments, please feel free to contact me through my e-mail address aberawakess2016@gmail.com.

Thank you in advance for your cooperation!

AberaWakessa

Note:

- No need of writing your name.
- Make a tick mark (√) on the space provided to show your responses.
- If you change your response, please cancel the former one.

Part I General information of respondents

1. Name of your woreda/town_____
2. Name of your school _____
3. Sex: Male ☐ Female ☐

4. Age_____

5. Grade 9th ☐ 10th ☐

Part II. For each of the following questions Please give your responses by putting "√" mark in the space/box/ provided under each questions

1. The current status of laboratory activities in secondary schools

1.1. Is there a separate room for biology, chemistry and physics laboratory works in your school?

Yes ☐ No ☐

1.2. Does your school science laboratory well equipped with chemicals, apparatus and reagents based on the student text book?

Yes ☐ No ☐

2. The presence of trained laboratory technicians and the extent of experience of schools in implementing of laboratory activities

2.1. Are there laboratory technicians separately for biology, physics and chemistry in your school?

Yes ☐ No ☐

2.2. When is lab session carried out in your school?

In its arranged period ☐ In opposite shift as make up class ☐

Has no regular schedule ☐

2.3. To what extent do you participate in science laboratory activities?

Very high ☐ high ☐ medium ☐ low ☐ very low ☐

2.4. How much the science laboratory activities conducted in your school laboratory rooms fit with the activities indicated in your text book?

Very high ☐ high ☐ medium ☐ low ☐ very low ☐

2.5. To what extent do you satisfied on the laboratory activities performed in your school?

Very high ☐ high ☐ medium ☐ low ☐ very low ☐

3. Factors affecting the implementation of science laboratory activities

3.1. The following points which are listed in the table are factors that can affect the implementation of laboratory activities: please try to rank them based on their severity in affecting it by putting "√"mark under the column of rank provided in the table according to the context of your school?

Items	Descriptions	Rank							
		1st	2nd	3rd	4th	5th	6th	7th	8th
1	Absence of separate Laboratory rooms for Biology, chemistry and physics								
2	Lack of enough Laboratory technicians								
3	Absence of reward								
4	Lack of appropriate laboratory schedule								
5	Lack of adequate Laboratory equipment, chemicals and materials								
6	Lack of teachers commitment								
7	Lack of students interest								
8	Teachers lack of training								

3.2. If there are another factors that can affect the implementation of science laboratory activities in your school; please list them down on the space provided bellow.

_____

_____

_____

Suggested solution to tackle these problems

3.3. The following points listed in the table below are Suggested solutions to the problems(factors) affecting the implementation of Science Laboratory activities; please try to rank them based on their priority to give the solution by putting "√ " mark under the column of rank provided in the table according to the context of your school?

Items	Descriptions	Rank					
		1st	2nd	3rd	4th	5th	6th
1	Employment of trained Laboratory Technicians						
2	Training of laboratory technicians						
3	Awareness training for teachers, principals and supervisors on laboratory activities						
4	Material support (furniture, chemicals, reagents)						
5	Preparing schedule for laboratory per week						
6	Setting up a well-equipped laboratory						

3.4. If there are another solutions to the problems (factors) affecting the implementation of science laboratory activities in your school; please list them down on the space provided bellow

_____

_____

_____

Appendix4. Interview guide to be filled by secondary school principals and Supervisors.

JIMMA UNIVERSITY

College of Education and Behavioral Sciences

Department of Teacher Education and Curriculum Studies

Dear respondent, I am **Abera Wakessa Gemeda,** MA student at Jimma University in the field of Curriculum and Instruction. As part of the requirements for the master's degree at Jimma University, I am conducting a study on **"The Implementation of Science Laboratory Activities at Secondary Schools of Oromia Special Zone Surrounding Finfine"**. Hence, you are kindly requested to voluntarily participate in this research endeavor by providing genuine and honest responses to the interview questions presented below as your responses are highly relevant for the success of the study. The information you provide will only be used strictly for academic purposes and will be kept confidential. Therefore, you are kindly requested to respond to the questions as per the instructions indicated under each part. If you have any question or comments, please feel free to contact me through my e-mail address aberawakess2016@gmail.com.

Thank you in advance for your cooperation!

Abera Wakessa

Note:

- No need of writing your name.
- Make a tick mark (√) on the space provided to show your responses.
- If you change your response, please cancel the former one.

Part I General information of respondents

1. Name of your woreda/town_____
2. Name of your school _____
3. Sex : Male ☐ Female ☐
4. Age_____
5. Level of education:- Diploma ☐ Degree ☐ Masters ☐
6. Overall service years (in teaching):- 1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐
7. Service year in this school:-1-5 ☐ 6-10 ☐ 11-15 ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ 36-40 ☐ 41-45 ☐

Part II. For each of the following interview questions Please give your detailed responses on the space provided under each questions

1. To what extent science Laboratory Activities carried out or performed in your School?

   ---
2. Has the Laboratory activity a normal schedule in your school? What are the reasons why laboratory activities were not performed as the normal schedule?

   ---
3. Are there enough Laboratory Manuals and safety materials to facilitate the implementation of Laboratory activities?

   ---

4. Is there a separate room for Biology, Chemistry and Physics laboratory works in your school?

---

5. Does your school science laboratory rooms well equipped with chemicals, apparatus and reagents based on the student text book?

---

6. If there is no separate Laboratory rooms for Biology, Chemistry and Physics what are the reasons for the absence of it?

---

7. What are the main factors that affecting the implementation of laboratory activities?

---

8. What attempts would be taken to avoid factors affecting the implementation of laboratory activities and by whom?

---

9. Are there well trained and separate laboratory technicians for Biology, Chemistry and Physics in your school?

---

10. What type of relationship is there between science teachers and science laboratory technicians in your school to implement laboratory activities?

Appendix5. Observation Checklist to be conducted and filled by the researcher

I. About facilities, Laboratory equipment, furniture and chemicals

No	Items of observation	Yes	No
1	Is there a separate Laboratory rooms for Biology, Chemistry and Physics?		
2	Is each Laboratory room filled with necessary Laboratory equipment and furniture?		
3	Is there Syllabus and teachers' guide for each three science Laboratory activities?		
4	Is there Laboratory manuals and safety rules for each of Biology, Chemistry and Physics Laboratory activities?		
5	Is there enough supply of Laboratory chemicals and reagents in each of Laboratory rooms?		

II. About Laboratory Technicians , Laboratory schedule and students participation

No	Items of observation	Yes	No
1	Are there Laboratory technicians for each Biology, Chemistry and Physics?		
2	Is there regular schedule/program for the conduction of Laboratory activities?		
3	Do students participate actively during Laboratory sessions?		
4	Is there student's laboratory activity report?		

III. About Laboratory plans, report formats and reports

No	Items of observation	Yes	No
1	Is there Laboratory annual and weekly plans other than regular class Biology, Chemistry and Physics plans?		
2	Is there uniform laboratory report formats and students' written laboratory reports for each science subjects?		
3	Is Laboratory activities included in Schools half year or annual reports?		
4	If the Schools half year or annual reports included the laboratory activities, is it clearly identified the status of implementation of science laboratory activities and factors affecting its implementation?		