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Factors Affecting Implementation of Practical Activities in Science education in Some Selected Secondary and Preparatory Schools of Afar Region, North East Ethiopia

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ABSTRACT

The study aimed at assessing factors affecting implementation of practical activities in science education in some selected secondary and preparatory schools of Afar Region. Practical activity is at the heart of mastery of science discipline and it is believed that if there is no practice either individually or in a group, all what have been learnt become inert knowledge. The implementation process of practices in science education is limited in Ethiopian schools and students in Ethiopia generally perform poorly in science subjects at secondary schools. Academically less prepared students of secondary schools prefer humanities and social sciences than science and technology in higher education. The majority of students in schools of the study area join social science. Therefore assessing factors affecting implementation of practical activities in science education in study area is important to identify root cause and forward the way for the improvement. Of the total 404 respondents from all schools, 68.81% responded as teachers do not use practical activities in teaching science and (78.71%) of them respond as they do less than 5% of the practical activities on their text books. Absence of separate and well equipped laboratory for each science, 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 influence on student's preference to science education in the study area. Therefore, attention should be given by all concerned bodies and stakeholders to solve the problem and encourage students to science practical activities to join science classes of future science and technology graduate.

KEYWORDS
Science education, practical activity, secondary schools, laboratory, afar

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Introduction

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). Study of science is important because it has the potential for improving the quality of life and making the world safer, empowers people, giving them greater control over their lives by providing path ways for finding answers to questions (Rein and Beach, 1997).

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 *et al*., 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.

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 learning science is enhanced and the understanding level is improved when students are engaged in science laboratory for practical experiments (Hofstein and Lunetta, 2004; Hofstein, 2004; Lunetta et al., 2007).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 result of using laboratory activities (Hofstein and Lunetta, 2003). However, the facilities for teaching science are not up to the mark at secondary and higher secondary stages (Dahar, 2011).

Secondary school is the base in preparing students for science education. It is at this level they were exposed to laboratory equipments, activities and precaution or safety rules. A high school laboratory should have the equipment necessary to conduct meaningful demonstrations and experiments. Teachers must 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). 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, currently 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 consideration to science education (Tesfaye *et al*., 2010).

However, production of quality professionals in science and technology is influenced by entrants who in turn influenced by the extent to which secondary education laid foundation in Mathematics and Natural Sciences as stated by Swail *et al*. (2003) cited in Hunde and Tegegne (2010). The implementation process of science education is limited in Ethiopian schools and students in Ethiopia generally perform poorly in science subjects (Samuel and Welflord, 2000).

Academically less prepared students of secondary schools prefer humanities and social sciences than science and technology. This not different in Afar region where majority of preparatory complete students join social science and humanities for their higher education study. The current study is aimed to assess factors that hinder the implementation of science education in secondary and preparatory schools found in Afar Region.

Basic Questions of the Study

Based on the stated problem, the study attempt to provide answers to the following questions.

1. Do teachers use practical activities in teaching science education?
2. How frequent do teachers use practical activities in teaching science education?
3. From the total practical activities in your science text books how money of them you did averagely?
4. What is the attitude of teachers in implementing practical activities in science education?
5. What is the interest of students toward practical activities in science education?
6. How do students involved in practicing science education?
7. Do each science subject in your school have their own laboratory?
8. Is the available laboratory well equipped?
9. Is Professional laboratory technician available for each course of each subjects?

Scope of the Study

The study was delimited to five school of Afar Region in which both secondary and preparatory students are available for the fact that the problem of this study is serious issue in the region. The study focused on grade 9 and 11 students. This is because grade 9 is the stage at which the students join their secondary school and have descion to focus on the area of their study while grade 11 is the stage at which students implement their descion of areas of the study.

Significances of the Study

The study may be significant in the following regards:

- This study would help Ministry of Education/ Afar Region Education Office to identify ways to attract students of the region to science education.
- It gives direction for Ministry of Education/ Afar Region Education Office to allocate resource to construct laboratory rooms and improve the existing laboratory facility.
- It helps the science teachers to hence love for practical activities and attract their students to science.
- It enables school principals to motivate teachers and laboratory technicians to use local materials to teach practical activity and make students use it.
- It helps local government of the region and other concerned stakeholders to be involved very much in improving the implementation of practical activities in science education so as to make students to join sciences to contribute to the 70:30 higher education intake ratio of the country in the region.

Methodology

Description of Study Area

Geographically, Afar Regional state is located in the northeastern part of Ethiopia. The total geographical area of the region is about 270,000 km^2 (CSA, 2008). It is geographically located between 39^{o}34' and 42^{o}28' East Longitude and 8^{o}49'and14^{o}30'North Latitude. The region shares common international boundaries with the State of Eritrea in the north-east and Djibouti in the east, as well as regional boundaries with the Regional States of Tigray in the north-west, Amhara in the south-west, Oromia in the south and Somali in the south-east. Administratively, Afar National Regional State consists of 5 administrative zones (sub-regions), 32 weredas (administrative districts), 28 towns, and 401 rural and urban Kebeles (Birru *et al*., 2010).

Study Design

Descriptive survey study was used to assess factors affecting implementation of practical activities in science education in some selected Preparatory Schools of Afar Region from February 2013 to December 2014.

Methods of Data Collection

The data was obtained from primary sources through self-administrated questionnaire. A sample from population was selected to generalize the whole students and science teacher's idea in order to make the overall conclusions.

Sampling Procedure

Stratified random sampling technique was used in order to get more precise estimators which represent the whole population. Five secondary and preparatory schools were randomly selected from the region and each school is taken as different groups.

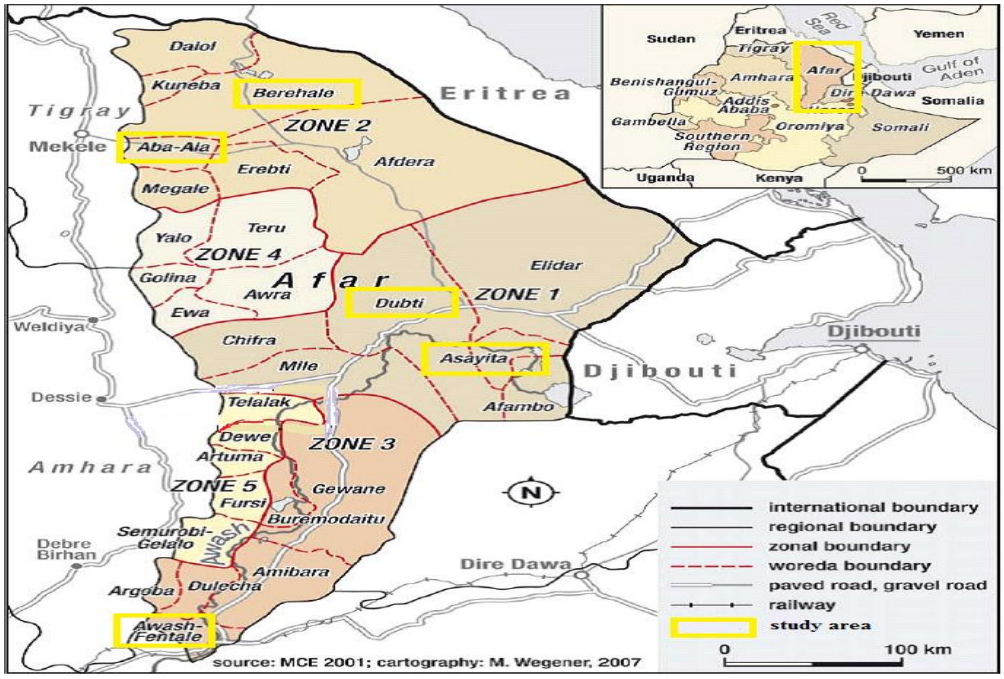

Figure 1. Map of the study area

Sampling Frame and Sample Size Determination

The target population was students of grade nine and eleven and science teachers. Of the total 2254 grade nine and eleven students, 404 students and of the total 46 science teachers 17 of them were randomly selected for the study.

Method of Data Analysis

The gathered data were reviewed, and then analyzed to form some sort of finding or conclusion. Both descriptive statistics such as frequency distribution, pie chart, and bar chart and inferential statistics were used to analyze the data.

Ethical Consideration

Consent Letter was written from Samara University to Afar region education bureau and from the bureau to the concerned secondary and preparatory schools. Before disseminating questionnaires' to students and teachers, formal permission was taken from the informants.

Result and Discussion

Table 1 below show total students participated in current study by school and sex. Of the total participated in the study 263 (67.96%) of them were male while 124 (32.04%) were female. The table also indicates, of the total students, 83 (21.45%), 65 (16.80%), 114 (29.46%), 22 (5.68%) and 103 (26.61%) were participated in the study from Aba'ala, Asayita, Awash, Berhale and Dupti secondary and preparatory schools respectively. Of the total students, the highest 114 (29.46%) respondents were participated from Awash Secondary and Preparatory school.

The table indicate of the total female (124) participated in the study, the highest 40 (32.26%) female were participated in the study from Awash Secondary and preparatory school. The data also indicate the participation female student in all school is far less than male which is the indication female participation in natural science is low compared to males in the study area.

Table 1. Student Respondents by Sex and Grade Level

Schools	Student Respondents by Grade Level						Total
	Grade 9			Grade 11			
	Male	Female	Total	Male	Female	Total	
Aba'ala	30	12	42	35	6	41	83
	(71.43%)	(28.57%)	(19.18%)	(85.37%)	(14.63%)	(24.40%)	(21.45%)
Asayita	23	24	47	12	6	18	65
	(48.94%)	(51.06%)	(21.46%)	(66.67%)	(33.33%)	(10.71%)	(16.80%)
Awash	37	27	64	37 (70%)	13 (30%)	50	114
	(57.81%)	(42.19%)	(29.22%)			(29.76%)	(29.46%)
Berhale	17	5	22				22
	(77.27%)	(22.73%)	(10.05%)				(5.68%)
Dupti	25	19	44	47	12	59	103
	(56.82%)	(43.18%)	(20.09%)	(79.66%)	(20.34%)	(35.12%)	(26.61%)
Total	132	87	219	131	37	168	387
	(60.27%)	(39.73%)	(100%)	(77.98%)	(22.02%)	(100%)	
Total Male		263 (67.96%)		Total Female			124 (32.04%)

Of the total grade nine students 219 (100%) participated in the study 132 (60.27%) are males while 87 (39.73%) of them are females. The highest number 64 (29.22%) of the students are from Awash secondary and preparatory school and lowest number 22 (10.05%) of grade nine students are participated in the study from Berhale secondary and Preparatory school.

Of the total grade eleven students 168 (100%) participated in the study 131 (77.98%) are males while 37 (22.02%) of them are females. The highest number 59 (35.12%) of the students are from Dupti secondary and preparatory school and lowest 18 (10.71%) of grade eleven students are participated in the study from Asayita secondary and preparatory school.

Table 2 below show teacher respondents of all schools participated in the study. Of all teacher 17 (100%) respondents participated in the study, only 1 (5.88%) are females from Berhale Secondary and Preparatory school while the rest are male teachers.

Table 2. Teacher Respondents by Sex

Schools	Teacher Respondents by Sex		Total
	Male	Female	
Aba'ala	3 (100%)	0	3 (17.65%)
Asayita	4 (100%)	0	4 (23.53%)
Awash	4 (100%)	0	4 (23.53%)
Berhale	1 (50%)	1(50%)	2 (11.76%)
Dupti	4 (100%)	0	4 (23.53%)
Total	16 (94.12%)	1 (5.88%)	17 (100%)

Table 3 below show student's response to teacher's use of practical activity in teaching science education. Of the total students participated in the study, 271 (70.03%) of them respond as their teacher do not use of practical activity in teaching science teaching while 116 (29.97%) respond as their teacher use practical activity in teaching science teaching. Of the five schools studied, highest number 50 (60.24%) of students responded from Aba'ala Secondary and Preparatory school as their teacher use practical activity in teaching science while lowest number of the students responded from Asayita 63 (96.92%) and Berhale 19 (86.36%) Secondary and Preparatory school as their teacher do not use practical activity in teaching science.

Table 3. Students Response to teacher's use of practical activity in teaching science Education

Schools	Students Response to teachers use of practical activity in teaching science		Total
	Yes	No	
Aba'ala	50 (60.24%)	33 (39.76%)	83
Asayita	2 (3.07%)	63 (96.92%)	65
Awash	40 (35.09%)	74 (64.91%)	114
Berhale	3 (13.64%)	19 (86.36%)	22
Dupti	21 (20.39%)	82 (79.61%)	103
Total	116 (29.97%)	271 (70.03%)	387 (100%)

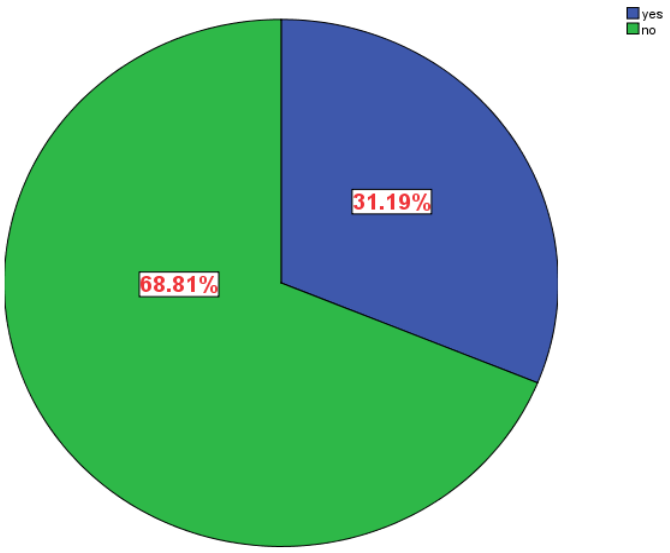

Figure 2. Percentage Teachers Use of Practical Activities in teaching sciences

Figure 2 below show percentage teacher's use of practical activities in teaching science. Of the total 404 respondents from all schools, 68.81% responded as teachers do not use practical activities in teaching science while 31.19% of them indicated as teachers use it.

Figure 3 below show percentage frequency of science teachers using practical activities in science. Of the total students participated in the study majority of them (53.96%) reported as their teacher do not use practical activity in teaching science while 21.04% of them indicated as their science teacher use it.

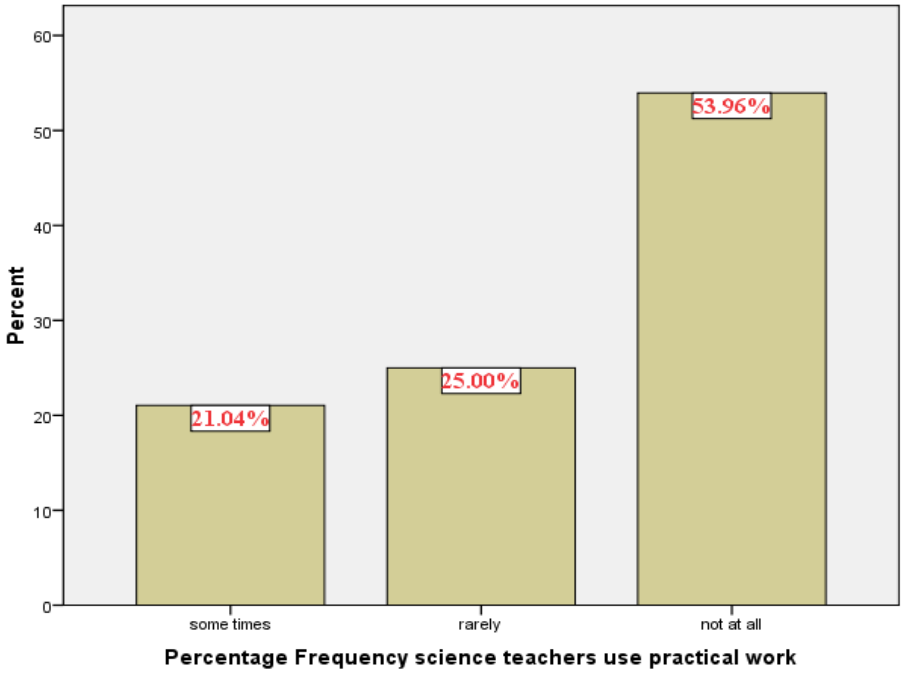

Figure 3. Percentage Frequency of Science Teachers Using Practical Work in Class teaching

Of the total 387 students participated in the study 202 (52.20%) of them replied as their science teacher don not use of which the highest respondents 60 (58.25%) were from Dupti Secondary school while 85 (21.96%) of them replied as their science teacher sometimes use practical activities in teaching science in the class. None of the respondents replied as their teacher very often use practical activities in teaching science. Of all schools under study, highest respondents 49 (42.98%) from Awash Secondary School respond as their teacher Sometimes use practical activities in teaching science while 39 (34.21%) from the same school respond as their teacher rarely use it.

Table 4 below show that, of all science teacher respondents none of them responds as they very often use practical activities in teaching while majority 12(70.59%) of them do not use it. The other 3 (17.65%) of them replied that they sometimes use practical activities. Of all schools, Awash secondary school is the only school in which teacher Sometimes 3(75%) and rarely 1(25%) use practical activity in teaching science.

Table 4. Students Response to frequency of using practical activity in teaching science Education

Schools	Students Response to Frequency of using practical Activity			
	Very Often	Sometimes	Rarely	Not at all
Aba'ala	0 (0.00%)	10 (12.05%)	19 (22.89%)	54 (65.06%)
Asayita	0 (0.00%)	11 (16.92%)	12 (18.46%)	42 (64.62%)
Awash	0 (0.00%)	49 (42.98%)	39 (34.21%)	26 (22.81%)
Berhale	0 (0.00%)		2 (9.09%)	20 (90.91%)
Dupti	0 (0.00%)	15 (14.56%)	28 (27.18%)	60 (58.25%)
Total		85 (21.96%)	100 (25.84%)	202 (52.20%)

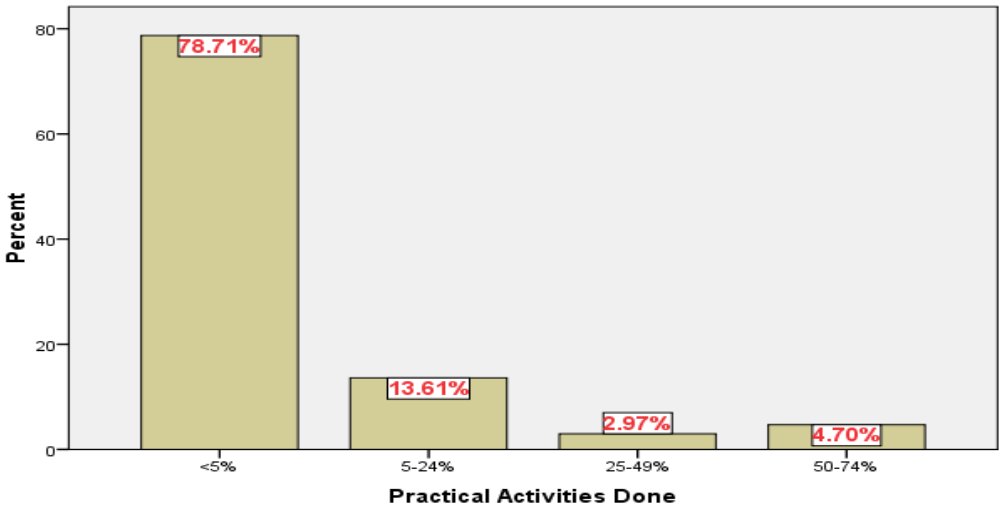

Figure 4. Percentage Practical Activities Done in the school

The above figure 4 show that of all respondents participated in the study, majority (78.71%) of them respond as they do less than 5% of the activities on their text books while small respondents (4.70%) indicate as they do 50.74% of activities on their text book. This indicates that majority of students in each school do less than 5% of the activities on their text books.

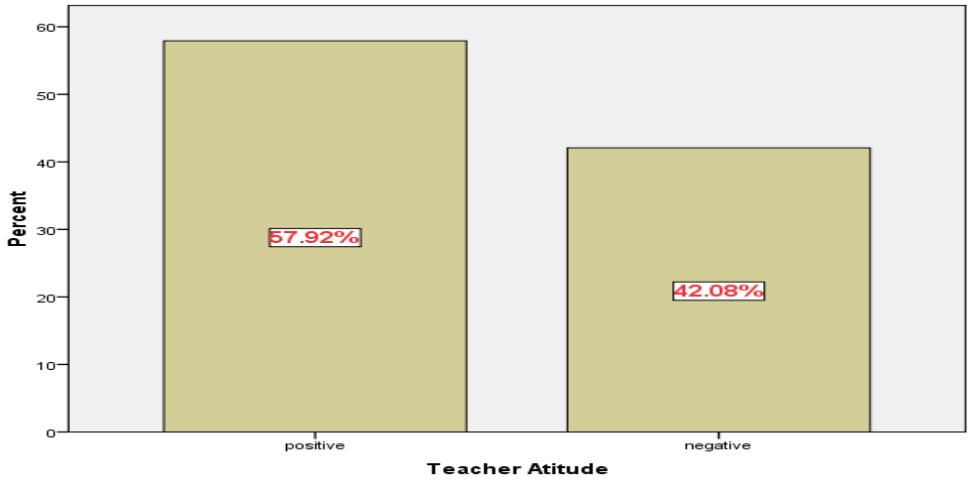

Figure 5. Teachers Attitude towards Applying Practical Activities in teaching science

The above figure 5 show that, majority (57.92%) of the teacher have positive attitude toward applying practical activities in teaching science while others (42.08%) of them have negative attitude toward applying practical activities. The science teacher in the each study school reported that even though they have positive attitude to practical activities, absence laboratory facility, less motivation of school principals to fulfill laboratory facility and environmental condition makes them not implement practical activities in science teaching.

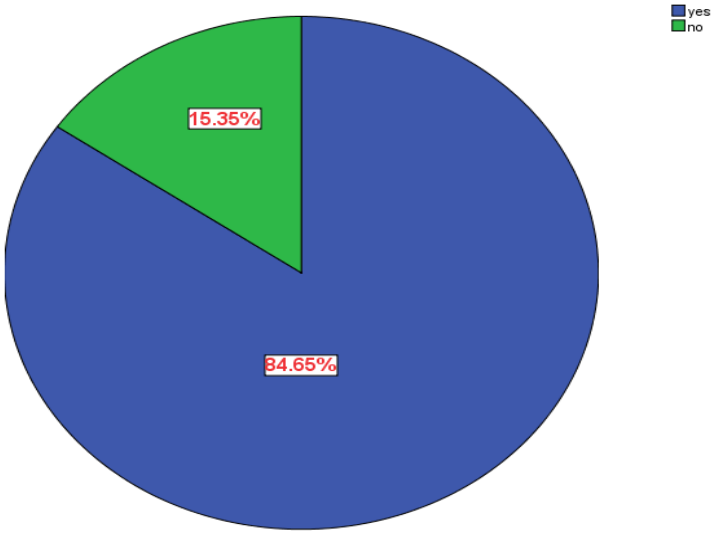

Figure 6. Students Interest towards Practical Activities

Figure 6 shows student's interest towards practical activities. Of the total respondents 84.65% respond as they have interest of learning practical activity while 15.36% of them have no interest to it. But the reason behind is less practical activity in separate laboratory rooms.

General secondary school is the base in preparing students for science and technology education and it is at this level where they were exposed to laboratories equipments, activities and precaution or safety rules. If there is no practice either individually or in a group all what have been learnt become inert knowledge (Jonassen, 1991). In the current study, for each science subjects, almost all secondary and preparatory schools have common laboratory. Each schools laboratories are not equipped and chemicals which are even important to small extent are missing. In all schools there is no facility except Awash and Aba'ala secondary schools in which there are some facilities but laboratories are not functional and equipments and chemicals are simply stored in non-ventilated store due to absence of skilled laboratory technicians and cooling system.

Similarly (Hunde and Tegegne, 2010) reported that Jimma university community school and Yebu school have laboratory which is not functional while Bilida school has no laboratory set up at all. Except Awash and Dupti which have plasma television instruction, others have no any plasma television distribution due to electric power supply problem and other factors and there is no continuous distribution even in those schools which have plasma television.

Therefore students in these schools are at a disadvantage compared to students who are receiving televised instruction who have at least exposure to laboratory equipments, demonstration of experiments. Similarly Jimma university community school, Yebu School and Bilida School in Jimma face the same problem due to absence of televised instruction which is useful for conceptual understanding of the practice (Hunde and Tegegne, 2010).

The study revealed that students have interest to learn practical activities. This is indifferent from the study conducted by Negassa (2014) in which the students were not interested to conduct practical activities. But the less admission and participation of students to science education result from assumption that less or absence of any practical activity in science subjects due to laboratory facilities have influence on their score in science and their future study.

The other factors is that, the room of available common laboratories are too small to hold all students and not suitable to work in, due to lack of ventilation as far as the temperature of the environment is very hot. In some schools even the rooms are not built for laboratory purpose, doors, windows, roofs are broken. Totally the laboratory rooms and laboratory environments are dirty and not suitable to work in.

This shared truth with the report of Tesfamariam *et al.* (2014) which most laboratory rooms available in secondary schools of Mekele town were not built for laboratory purpose and lacked even the most basic facilities like running water, source of electricity; working tables, sinks, hoods, the rooms windows, roofs and doors are broken. These forces all under study school teachers to use only theories to teach their students. This is similar with idea that "most high schools in Ethiopia used to teach practical subjects theoretically without adequate support with experiments due to high scarcity of laboratory equipments and chemicals" (FDRE, 2004).

Students' interest and their academic achievement in science education have direct relation and as the same time affective practices of students in classroom are strongly related to their academic achievement (George and Kaplan, 1998).

Students are effectively successful through practicing the subject matters. Farounbi (1998) argued that students tend to understand and recall what they see more than what they hear as a result of using laboratories in the teaching and learning of science students so as to get better achievement. Laboratories have multiple benefits ranging from making learning concrete to lying basis for science education in the subsequent levels (Hunde and Tegegne, 2010). Students in current study schools were deprived of such opportunities because of the following hindering factors, which makes negative impact on students' preference to science education.

- The absence of separate well-equipped laboratory in each school under study.
- The absence of laboratory technician for each science (Biology, Chemistry and Physics) in the school, who can carefully facilitate and lead the laboratory procedure.
- Absence of well-prepared laboratory manuals.
- Chemicals, apparatus and laboratory room give less function for the fact that the chemicals on the laboratory are highly expired and outdated, and dangerous for the students.
- The laboratory room does not match with the number of students.
- Some schools do not have totally laboratory rooms and even those which are available not suitable for work.
- Very hot environmental condition and absence of cooling system in areas where the schools available is another factor.
- Less attention is given from administrative government of the region and school administrators to sciences education
- Less motivation of science teachers to use local materials to at least conduct basic activities on student's text.
- Absence of televised instruction which at least exposes students to practical materials, procedures and diagrams in most schools in the study area and non-continuous functionality of the television even the school it available.

Conclusions and Recommendation

It has been found that teaching science without practical activities have effect on student's interest towards science disciplines which result in less student enrolments in science class. The hindering factors identified in the current study make students do not get satisfactory laboratory practices. As a result of these students at secondary and preparatory schools of Afar region lack interest to join science class.

In each school under study, female student enrollment to general secondary school is less which is far less in preparatory schools compared male indicating less preference to science education. As the same time students enrollment to science class is different in each school.

From the study, it is possible to conclude that even though there is no separate laboratory for each science and even the existing laboratory is not well equipped which is not suitable for conducting activities, there is no efforts made by science teacher to use local material even to show demonstration to science

students. This results in less student motivation to practical activity which have influence on student's preference to science education.

In generally, less local government education office, school administrators and community attention to fulfill laboratory facility, less commitment of science teachers to fully use the effort to encourage their students to practices and less motivation of students, implementation of practical activities in secondary and preparatory school of the study area is by far less and result in less preference and admission of students in science classes.

Therefore, Ministry of Education, Afar region education bureau should launch science education project in the study area which focuses on school laboratory establishment and facility fulfilling as well as enhancing knowledge and skills of science teachers. A great awareness on the importance of science education has to be given to students by role model professionals, educational structural organizations and science teachers.

Science teachers and other concerned bodies should be committed to build students' confidence in their ability to do well and better. They should check the practice of students' science education for students in general to female students in particular so as to enhance the low performance of students in the science subjects. On the other hand students should take an active role by taking responsibility for their own learning, ask their teachers and school principals for the fulfillment of their laboratory and ask their teachers to encourage and assist them to use local material for practice.

The nearby Samara University and Mekele University in collaboration with other institution should work on the schools science teacher capacity building, make the available laboratory functional by giving training, by making arrangements of the laboratory through their community service project.

Ministry of Education and Afar Education Bureau should construct standard laboratory classes separately to each science subjects; fulfill well-trained laboratory technicians, chemicals, apparatuses, well-designed laboratory manuals and fix cooling system to chemical store and the laboratory at whole. Parents should get effective awareness on the importance and benefit of science education by school principal and other concerned bodies so that they can support their children's effectively and send them to admit science class. Local or international NGOs should focus in improving science education in general secondary schools.

In generally**,** since, Ethiopia's higher institution training focuses on science and technology through 70:30 policy to transform agricultural led industry to industry led agriculture, the country needs well trained man power in the fields of science and the central missions of all schools are to produce good citizens, academically talented and future scientists. Therefore, in order to have students with high science achievement, schools should give special attention to the implementation of effective practical and laboratory activities in science teaching and attract students to science classes in secondary schools.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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