

Full Length Research Paper

Status of biology laboratory and practical activities in some selected secondary and preparatory schools of Borena zone, South Ethiopia

Tolessa Muleta Daba*, Baressa Anbassa, Bula Kere Oda and Itefa Degefa

Department of Biology, Bule Hora University, P. O. Box144, Bule Hora, Ethiopia.

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Science laboratory is a very important resource input for teaching science. Learning science is enhanced and the understanding level is improved when students are engaged in science laboratory for practical experiments. The current study aimed to assess the status of Biology laboratory and practical activities in some selected secondary and Preparatory schools of Borena Zone. A random sampling technique was employed to collect data from students, Biology teachers and technicians of the study schools. Structured and semi-structured questionnaires and observation of laboratories and other facility was used. All respondents (100%) from Kilenso School respond as there is no laboratory room while majority of respondents (80.2%) from Bule Hora School respond as they have common laboratory for each science and no separate laboratory for Secondary and Preparatory school. In all schools there is no facility, equipments and chemicals are simply stored in non-ventilated laboratory room due to absence of skilled laboratory technicians and even no cooling system. The current study is similar to report of Hunde and Tegegne (2010) in which Jimma University community school and Yebu School have laboratory which is not functional while Bilida School has no laboratory set up at all. The study is also similar to the report of Tesfamariam et al. (2014) in which most laboratory rooms available in secondary schools of Mekele town were not built for laboratory purpose and lacked even the most facility. Absence of laboratory practical activities makes students at secondary and preparatory schools of the study area lack interest to join science class.

Key words: Laboratory, secondary school, practical activity, biology.

INTRODUCTION

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

*Corresponding author. E-mail: tolessan2012@gmail.com.

improved when students are engaged in science laboratory for practical experiments (Hofstein and Lunetta, 2004; 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). 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 they were exposed to laboratory equipments, activities and precaution or safety rules. A 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, 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 (Tefaye 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 Natural Sciences (Swail et al., 2003). 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 the

study area where majority of preparatory complete students join social science and humanities for their higher education study. Therefore, the current study is aimed to assess the status of Biology laboratory and practical activities in biology class of selected secondary and Preparatory schools of Borena Zone.

METHODS AND MATERIALS

Description of study area

Borana zone is one of 13 administrative zones within Ethiopia's Oromia state. It is located in the Southern part of the state and borders of Kenya. Yabello is the capital town of the zone and lies 570 km south of Addis Ababa. The zone covers 48,360 km² of which 75% consists of lowland; the zone is frequently exposed to droughts (Lasage et al., 2010).

Study population and sampling techniques

The subject of this study is students of grade nine to twelve, Biology teachers, laboratory technician and observation of the laboratory.

Study design, methods of data collection and sampling

Descriptive survey study was used to assess the status of Biology laboratory and practical activities in biology class of selected secondary and preparatory schools of Borena zone from February 2016 to June 2016. 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 to make the overall conclusions. 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 schools available in Borena zone. The target population was students of grade nine, ten, eleven, twelve and science teachers.

Data analysis

The gathered data was reviewed, and then analyzed to form some sort of finding or conclusion. It was analyzed using SPSS, interpreted quantitatively and qualitatively, presented in tables and statements.

Ethical consideration

Consent Letter was written from Bule Hora University to each school. Before collection of data through observation and questionnaire from students and teachers formal permission was taken from the schools and informants.

RESULTS

Status of biology laboratory

Figure 1 shows the status of Biology laboratory in each

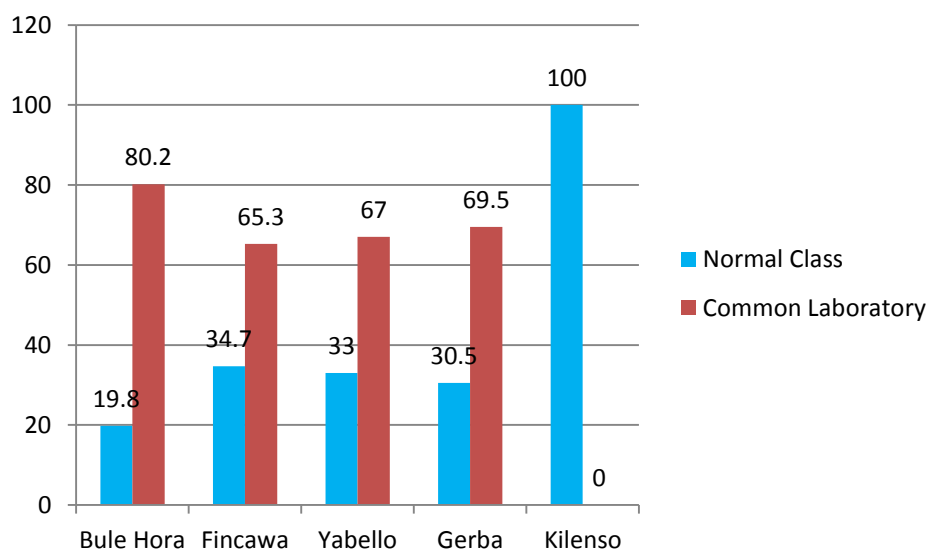


Figure 1. Status of biology laboratory in schools under study.

school under study. Of the total student and teacher respondents from Bule Hora, Fincawa and Yabello schools, majority of respondents (80.2%) from Bule Hora School respond as they have common laboratory for each science and no separate laboratory for Secondary and Preparatory school. Similarly of respondents from Fincawa 65.3% responded as there is no separate laboratory for each science education while 34.7% respond as they use normal class for laboratory. This may be because since preparatory schools have no any laboratory facility and it is only the room that is found and the teachers use normal class for laboratory. The result also shows that of the respondents from Yabello, 67% of them responded that they use common laboratory for all sciences and for both secondary and preparatory schools. Respondents of Gerba secondary school, 69.5% responded as there is one common laboratory room which is not functional and remains closed through each year. All respondents (100%) from Kilenso School responded as there is no laboratory room and its facility in Kilenso Secondary school.

Facility available in biology laboratory

The Figure 2 shows that, of the total respondents from Bule Hora School, 75% of them responded as the existing laboratory is empty while 25% of them respond as the laboratory is poorly equipped. Of respondents from Fincawa, 90% of the respondents replied as the existing laboratory is empty while 10% said that the laboratory is poorly equipped. But 50% of respondents from Yabello School responded as the existing laboratory is empty. Respondents from Gerba School said that even though they do not know whether laboratory have facilities since

it was not opened yet and not functional through each year, 65% of them replied as the available laboratory is poorly arranged. In Kilenso secondary school all respondents (100%) said no science laboratory at all rather empty normal teaching classroom.

Arrangement of biology laboratory

Figure 3, indicates arrangement of Biology laboratory and of the total respondents from all schools, 87.5% of the respondents from Fincawa school replied as the existing laboratory is not arranged while 70.1% from Gerba also indicated as the laboratory is not arranged. Half of respondents (50%) from Bule Hora School respond as the existing laboratory is not arranged while lowest number (37.5%) from Yabello school responded as the existing laboratory is not arranged. Due to absence of any laboratory or laboratory room in Kilenso School, all of the respondents (100%) replied as the laboratory is not arranged.

Frequency of practical activities performed in the schools

Table 1 shows the frequency of practical activities in all schools. Of total respondents, 70% replied that they were not used practical activities available on their book at all while 8.8% of them responded as they always use practical activities.

Performed practical activities from text book

Figure 4 shows the percentage performed practical

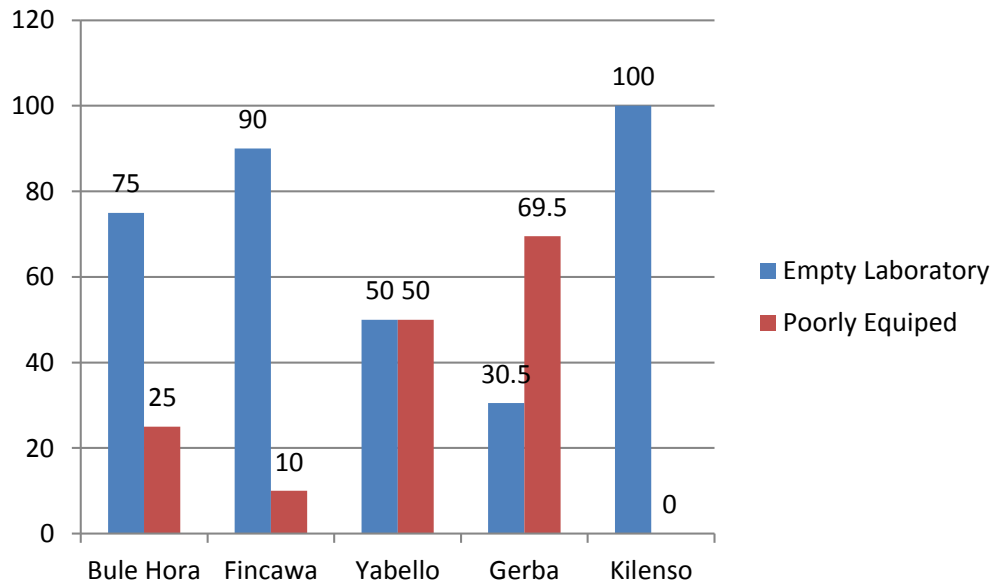


Figure 2. The facility of each school biology laboratory.

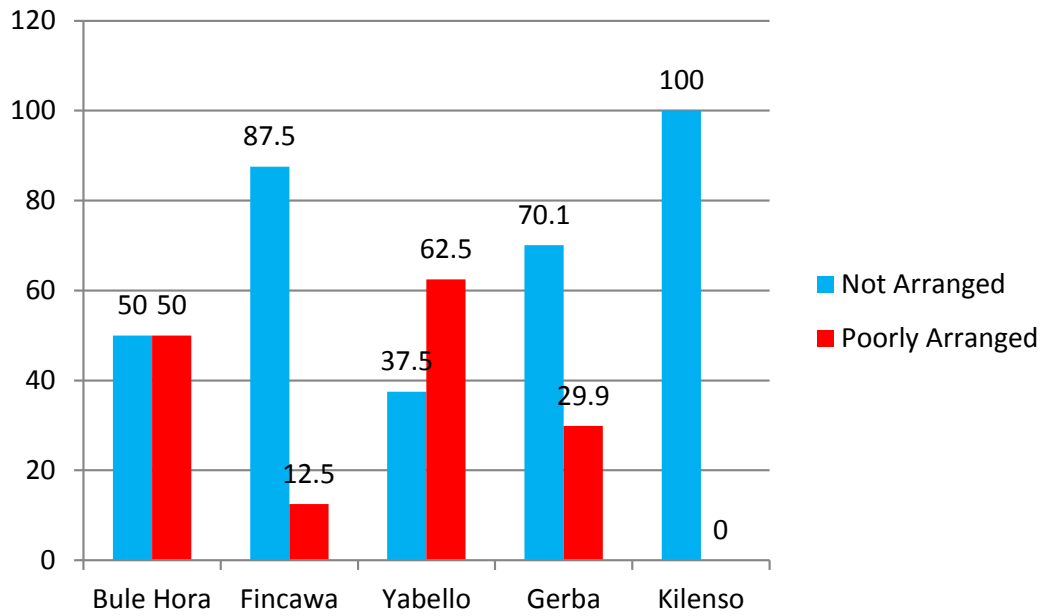


Figure 3. Arrangement of biology lab.

Table 1. The frequency of practical activities in schools.

Variables	Frequency	Percent
Not at all	182	70.0
Sometimes	55	21.2
Always	23	8.8
Total	260	100.0

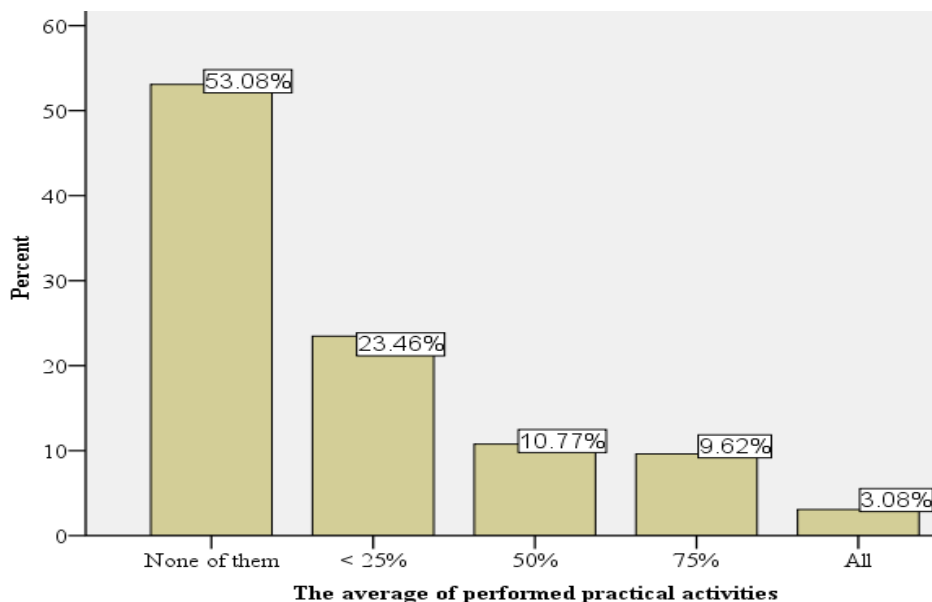


Figure 4. Average of the performed practical activities in schools.

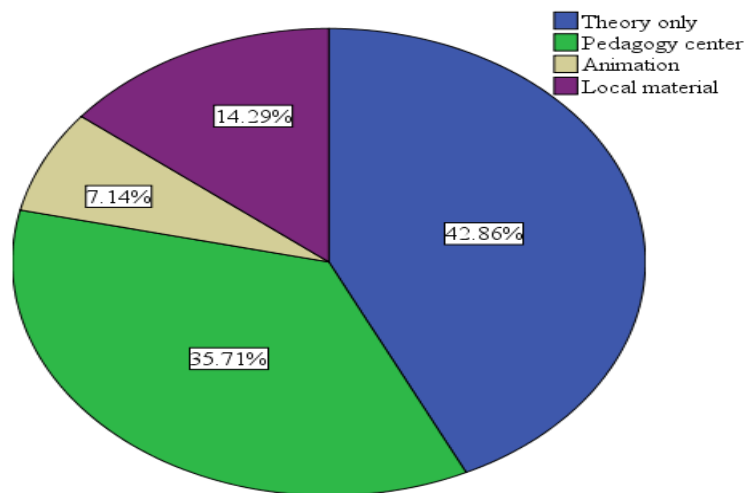


Figure 5. The other possible ways of teaching in the schools.

activities on text book. Of the total respondents from all schools, majority (53.08%) of them replied as none of practical activities found on their text book is performed while 23.46% of them replied as they perform one fourth (25%) of the total practical activities found in their text book. Only 3.08% of the respondents replied as they perform all of the activities found on their text book.

use different ways of teaching which may help students to acquire practical areas of the lesson. Figure 5 shows that out of the total respondents from all schools, the majority (42.86%) of them replied as they use only theory for any lesson while about 35.71% of them use pedagogical center to cover the practical lesson of the subject. Lowest number (7.14%) of respondents replied as their teachers use animation to teach sciences.

Availability of other ways of teaching

To composit the absence of laboratory, schools may

Interest of students towards the practical work

Table 2 indicates the interest of students towards

Table 2. The interest of students towards practical work.

Variable	Frequency	Percent	Valid percent
Less	51	19.6	19.6
Fair	14	5.4	5.4
Very much	195	75.0	75.0
Total	260	100.0	100.0

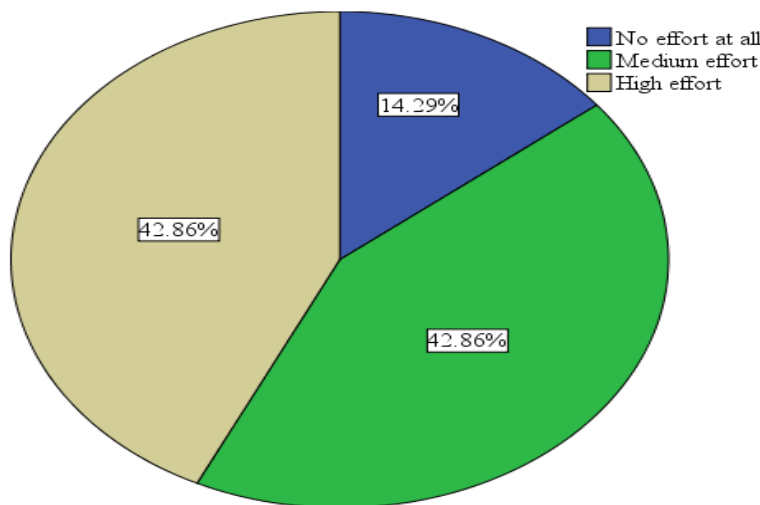


Figure 6. The effort of teachers to perform practical activity.

practical activities, of the total respondents, 75% of the respondents replied as they are interested towards practical activities whereas 5.4% respondents said as practical activities are fair.

The effort of teachers to solve problem laboratory

Of the total respondents from all schools (Figure 6), 42.86% of the respondents replied that there is high effort of teachers to solve the problem of laboratory while 14.29% of the respondents replied as their teacher did not make any effort to solve problem of laboratory.

Challenges for Biology Laboratory

Many challenges made the availability of science laboratory in general and biology laboratory in particular in the study area. Among these; absence of chemicals, absence of laboratory equipment, unsuitable laboratory class room, absence of separate biology laboratory and other challenges were observed. Figure 7 shows that, of the respondents from all schools, majority of them

28.57% replied absence of separate laboratory is the major challenge while 21.43% of them responded that absence of laboratory equipment and other related factors are challenges for biology laboratory activities to be conducted. Others (14.29%) respond as unsuitable laboratory room made the challenges of biology laboratory in the study area.

Factors affecting absence of science laboratories in school of study area

In majority of Ethiopian secondary and Preparatory schools science laboratories are not available or the available ones are not furnished and fully equipped so as to conduct practical activities. This may be due to different factors. The following factors are some of the factors raised by respondents that hinder the availability of laboratories and less facility even in the existing laboratory. Majority (35.71%) of respondents replied, less attention of school principal to laboratory and practical activities in science education is the major factor of unavailability of laboratory while 21.43% responded as lack of finance and other related factors are the cause for

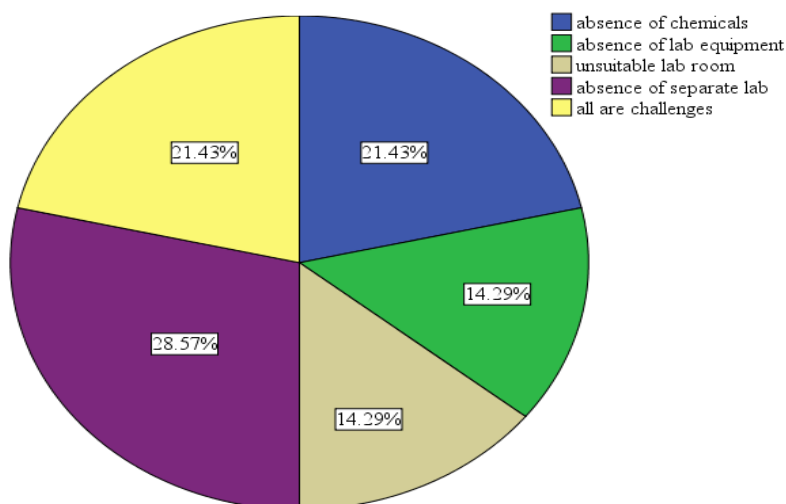


Figure 7. Challenges of biology laboratory the schools.

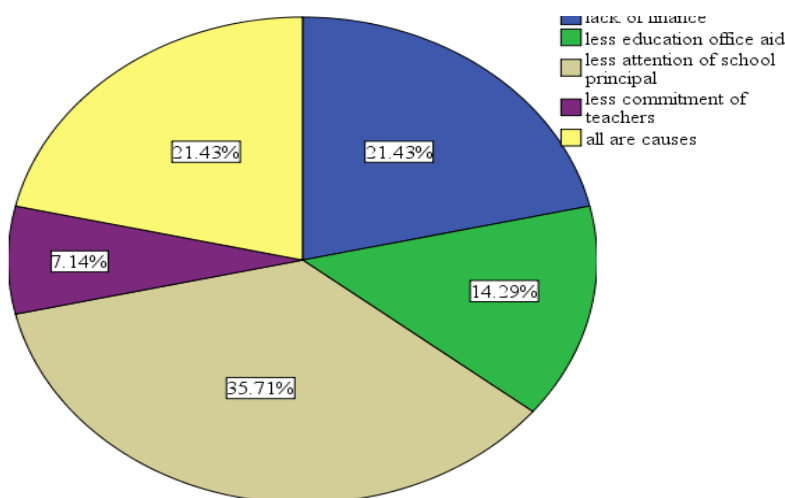


Figure 8. Major causes of laboratory challenges in schools.

functioning of laboratories in the study area (Figure 8). The other factors are less attention from education office (14.29%) and less commitment of teachers (7.14%) to use the available local material to practice some of the activities.

Help that school require

To tackle the challenges raised above, the schools need the following help from the concerned bodies (Figure 9). Of the total respondents, majority (50.00%) of respondents replied that they need basic laboratory chemicals and reagents while 28.57% require basic

biology laboratory training for their staff to improve the challenges. The other 14.29 and 7.14% respondents replied that they need all aspect of help and laboratory setup, respectively.

DISCUSSION

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

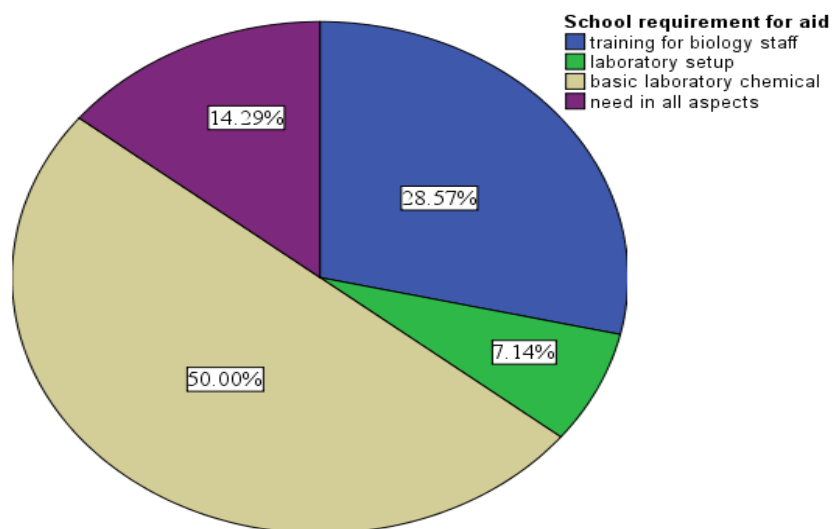


Figure 9. Help request of schools under study.

the current study, for each science subjects, almost all secondary and preparatory schools have no laboratory and the existing laboratories are non-functional due to different factors. In school like Kilenso secondary school there is no even laboratory room while Fincawa Preparatory school there is only empty laboratory room. In Fincawa working bench, laboratory equipments, chair and other important materials are missing. In each school where laboratory is available, laboratories are not equipped and chemicals which are even important to small extent practical activities are missing. In all schools there is no facility, laboratories are not functional, equipments and chemicals are simply stored in non-ventilated laboratory room due to absence of skilled laboratory technicians and even no cooling system. The majority of chemicals in Gerba secondary school, Bule Hora secondary and preparatory school, Fincawa secondary school and Yabello secondary school stored for long period of time without any usage and expired. There is no separate laboratory for preparatory and secondary school as well as for each science in Bule Hora and Yabello schools.

The study revealed that majority 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. However, the less admission and participation of students to science education results from assumption that is less or absence of any practical activity in science subjects have influence on their score in science and on their future study due to lack of laboratory facilities. Another factor is that the room of available common laboratories is too small to hold all students and unsuitable to work in, and there is no ventilation in it. In some schools, even the

rooms did not build for laboratory purpose, doors, windows and roof are broken and closed for long period of time. Totally the laboratory rooms and laboratory environments are dirty and not suitable to work in. The chemicals available in schools like Gerba, Bule Hora, Fincawa and Yabello secondary schools were bought when the schools started work, and now they are expired. 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 and the rooms windows, roofs and doors are broken. These forces all under study school teachers to use only theories to teach their students. The issue 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 at the same time affect practices of students in classroom and 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.

1. The absence of separate well-equipped laboratory in each school under study.
2. The absence of laboratory technician for each science (Biology, Chemistry and Physics) in the school, who can carefully facilitate and lead the laboratory procedure.
3. Absence of well-prepared laboratory manuals.
4. Chemicals, apparatus and laboratory room give no function for the fact that the chemicals on the laboratory are highly expired and outdated, and dangerous for the students.
5. The available laboratory room does not match with the number of students.
6. Some schools do not have total laboratory rooms and even those which are available not suitable for work.
7. Less attention is given from administrative government of the region and school administrators to sciences education.

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 makes students not to get satisfactory laboratory practices. As a result of these, students at secondary and preparatory schools of the study area lack interest to join science class. 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 has influence on student's preference to science education. In general, less local government education office, school administrators and community attention to fulfill laboratory facility, and less implementation of practical activities in secondary and preparatory school of the study area results in less preference and admission of students in science classes.

Therefore, Ministry of Education, Borena zone 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

check the practice of students' science education for students in general and 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. Ministry of Education and/or Oromiya education Bureau should construct standard laboratory classes separately to each science subjects; fulfill well-trained laboratory technicians, chemicals, apparatus, well-designed laboratory manuals and fix cooling system to chemical store and the laboratory at whole. Local or international NGOs should focus in improving science education in general secondary schools.

The nearby Bule Hora 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. In general, 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.

Conflict of interest

The authors have not declared any conflict of interest.

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