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The Effect of Practical Work to Enhance 91th Grades` Attitude and Achievement in Biology Class

Sitotaw, Chekula

THE EFFECT OF PRACTICAL WORK TO ENHANCE 9TH GRADES `ATTITUDE AND ACHIVEMENT IN BIOLOGY CLASS

By: Chekula Sitotaw

A thesis submitted in partial fulfillment of the requirment of degree of Master of Education in Educational Sciences

Bahir Dar University

Department of Teaching Science

College of Education and Behavioral Science

June 2019

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APPROVED BY BOARD OF EXAMINERS:

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ADVISOR	SIGNATURE	DATE
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EXAMINER	SIGNATURE	DATE

BAHIRDAR, ETHIOPIA

JUNE, 2019

DECLARATION

I declareed that this entitled **The Effect of Practical Work to Enhance 9th Grades` Attitude and Achivement in Biology Class** senior essay is my own original work, has not been presented for Masters or other degrees in any university and that all sources or materials used in the thesis have been dully acknowledged.

NAME	**SIGNATURE**
Chekula Sitotaw	_____

JUNE, 2019

This senior essay is submitted for examination with my approval as an advisor of the candidates.

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Advisor: Asrat Dagnew (PhD)

June, 2019

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Acronyms

BAQ ---------- BIOLOGY ATTITUDE QUESTIONNAIRE

BAT ----------BIOLOGY ACHIVEMENT TEST

SAT ----------SCIENCE ATTITUDE TEST

ISPST ----------INTEGRATED SCIENCE PROCESS SKILL TEST

Abstract

The aim of this study was to investigate the effects of practical work enriching instruction of biology lessons on 9th grade students' attitudes toward biology lessons and thair achievement based on students' success. This study is conducted with 59 students of 9th E in diaspora secondary school thought biology course in 2019 G.C. And the sample selected randomly from the total 8 sections of 9th graders. Attitude pre-test , attitude post-test, achivement pre-test and achivement post- tests are employed for all participants in addition to intervewing four students randomly selected from the total participants. Experimental teaching method was used for two weeks for all participants on one of the lesson selected randomly in the text called osmosis and diffusion. . attitude pre-test, attitude post-test, achievement pre-test and achivement post - tests are employed for all participants in addition to interviewing four students randomly selected from the total participants. The test was applied to students in two different times. The first test was applied before and the second test was applied after the intervention. Paired sample (dependent sample) t-test was used to compare the two results of students' attitude and achievement test by using 5 % level of significance. According to the research results, it was found that experimental teaching method was more effective in the attitude and achievement level of students in some biology lessons, attitude and achievement has positive correlation. So the study recommend that high school biology teachers should plan their lessons in more practical way to boost (enhance) learners attitude as well achievement. All stakeholders including curriculum planners should take part in the planning process.

Key words

Practical work , Attitude , Achivement , Hands on activity ,Enhancement , Teaching method , Effect

CHAPTER ONE

INTRODUCTION

This chapter presents the background of the study, statement of the problem, objective of the study, significance of the study, limitation of the study, delimitation of the study and operational definition of terms by relating with different scholar articles.

1.1 Background of the study

Practical work is an essential part of science education. In science lessons, we are trying to extend students' knowledge of the natural world and develop their understanding of the ideas, theories and models that scientists have found useful in explaining and predicting its behavior. Teaching science naturally involves showing learners things, or putting them into situations where they can see them for themselves (Abrahams, 2009). According to Bell (2008), there are many reasons why practical work is necessary some of the most frequently mentioned purposes cited by teachers include

- To encourage accurate observation and description;
- To make phenomena more real;
- To arouse and maintain interest;
- To promote a logical and reasoning method of thought.

Therefore, the main objective of the practical activity is to help students develop their knowledge of the natural world and their understanding of some of the main ideas; theories and models that science uses to explain it, to help students learn how to use some pieces of scientific apparatus and/or to follow some standard scientific procedures, and to develop students' understanding of the scientific approach to enquiry (Abrahams, 2009).

It is needless to mention the central role practical work has in the curriculum and its essential nature for science learning. Specifically, practical work has a key role in teaching science subjects such as biology in secondary school. However, practical work faces several challenges, including how to ensure that it is effective in helping learn science. Some research into the teaching and assessment of practical work has been done. For example, projects such as getting practical have shown the importance of analysis in the planning of activities and supporting hands on, mind on approach to teaching (Needham, 2014). But, more research is needed. Most commonly, the challenge of practical work is to find ways to make it more effective as a teaching and learning strategy than it often is at present. The possible measure to make it practical work more productive include identification of learning objectives; informed analysis of the learning demand of tasks; and the design and presentation of tasks to assist students in thinking about their actions and their data in the way it is intended. According Abrahams (2009), improvement is not a matter of doing more practical work, but of doing better practical work. Adebayo (2015) recommends the following measures as far as what a teacher should do. The teacher should:-

- Unfold to the students the relevance of practical aspect to theoretical concept of science;
- Involve the students while preparing for science practical class;
- Diffuse the negative impression embedded in the students that practical science is difficult;
- Apply grouping method of instruction in case where the students outnumbered the available apparatus for a type of experiment and
- Change students' attitude towards science.

Often students display similar attitude towards practical work. Most consider practical work as important part of learning biology; an interesting activity during biology lesson; and an easy part of learning biology (Hinneh, 2017). The question is does students' attitude about the importance of practical work significantly influence their achievement in biology while their attitude concerning interest and difficulty of practical work do not significantly influence their achievement in biology. It can be concluded that even though students demonstrate some level of positive attitude towards practical work in biology in terms of its importance, the experience students gain from doing practical work in the biology lessons do not motivate them to want to pursue career in biology beyond secondary school. A possible explanation could be the manner in which practical work is carried out in secondary school negatively influences their achievement in the subject.

In other words, students' general attitude towards practical work is positive but would it influence their achievement in biology. There is clearly an overall positive attitude towards practical work and there are some good examples but there are also several messages that need to be addressed. There is well-documented evidence, in secondary schools in general and Diaspora secondary school in particular, about the shortcomings of equipment funding, particularly in secondary schools; the need is to ensure that those who make decisions in these matters are well-informed. There are currently no serious threats to practical science from health and safety requirements, but the situation needs to be kept under review. Locally, in some secondary schools, pupils' behavior and a lack of technical expertise may result in significant reductions in practical science. The current assessment demands are damaging practical science.

According to Bell (2008), although many teachers are dissatisfied with the amount of time and resources for practical science and some have experienced falls in provision, the time devoted to it is still substantial. Mentoring of inexperienced teachers can build confidence in practical science.

Opportunities for training and professional development, particularly for secondary teachers and for technicians, are inadequate. Frequent use of live organism in biology lessons and/or practical works may increase students' interest toward biology (Prokop, 2007).

Daba (2016) documented problems relating to laboratory facilities in secondary schools in Ethiopia. Some of these problems include:-

- No separate laboratory for each science
- Even the existing laboratory is not well equipped

  Llaboratories mostly unsuitable for conducting activities;
- No efforts made by science teacher to use local material even to show demonstration to science students.

This most probably results in less student motivation to practical activity which has influence on student's preference to science education in Ethiopia

A review of the current literature has yielded many studies pertaining to correlations between practical work and students' attitude. The study focus on how much the implementation of practical work in Diaspora secondary school affect learners attitude towards the study of biology as a science subject.

Attitude towards biology

Attitude is a very important factor in influencing human behavior and it affected by personal opinion, and these opinions can be formed through personal life experiences and education. Students' intrinsic motivation to learn biology is significantly correlated to students' interest to

biology and students' perceived difficulty of biology (Evangelia, 2012). The need of students to acquire positive attitude towards science subjects because science is different from most of the other discipline where the task is simple. Developing students' attitude positively increases and motivates students' interest in the study of science which in turn brings positive development to both the nation and the individual (Hena, 2015). The attitude of students towards science is positive (Tenaw, 2013). Students' attitude toward science showed a positive correlation with the performance goal orientation, learning goal orientation, self-efficacy, meaningful learning, and rote learning, science achievement and students' NOS views (Hacieminoglu,2016).

Attitudes toward science involves the students' affective behaviors; for example preference, acceptance, appreciation and commitment. While students' negative attitudes toward science are related to a traditional approach in science instruction, their positive feelings are associated with constructivist science classrooms (Hacieminoglu, 2016). Teaching science with the past approach and traditional teaching methods can affect students' academic achievement in science education. (Beyessa, 2014). Most of the students in Debre Markos believed that the topics studied in science class are interesting. And the central source of the students interest is experiments in science (Tenaw, 2013) .

Traditional teaching and over dependence on textbooks could be responsible for the increasing negative student attitudes about science. Students with positive attitudes towards science tend to have higher scores on the achievement measures. This result showed that students having a more positive attitude towards science preferred to undertake meaningful learning rather than rote learning, resulting in the achievement of higher scores (Hacieminoglu, 2016)**.** As the above research state the findings show quarter of students have no interest on biology. There is no statically significant difference between attitude towards biology and students' biology achievements (Nasr, 2011).

As the above research show students have appositive attitude towards science as well biology in deferent countries. But in our country there is no sufficient study on the effect of practical work on students' attitude towards biology lessons on the specific topic of osmosis and diffusion. This is why the study focus on the effect of practical work on enhancing attitude of students towards biology lessons particularly on osmosis and diffusion, On the case of Ethiopia particularly in diaspora secondary school.

1.2 Statement of the problem

Making the teaching learning process more practical help teachers to build positive attitude towards the subject they are teaching and to enhance learners' achievement. There are a range of purposes for practical science, indeed there are several purposes for science education as a whole (e.g. science as general education as well as training for future career paths). Ample evidence is available that indicate the existence of positive attitude that teachers and pupils have to practical science. Although the evidence of pupil attitudes is equivocal, more research in the issue would benefit the effectiveness of practical work. Bell (2008) argues that teachers' and other stakeholders' have positive attitudes based on their answer to the question "how important is practical work in science education". As one head of science put it "it is vital and teaching science without practical work is like swimming without water" (Bell 2008). So implementing more practical work in science education improve learners attitude as well their achievement in biology.

It is very clear that practical work in itself does not automatically improve learning in science rather it must be fully integrated as a major element of effective pedagogy in science. When well-planned and effectively implemented, science education laboratory and simulation experiences situate students' learning in varying levels of inquiry requiring students to be both mentally and physically engaged in ways that are not possible in other science education experiences. Social learning theory makes clear

the importance of prompting group work in the laboratory so that meaningful conceptually focused dialogue takes place between students as well as between the teacher and the students, in particular the way to make the links between hands-on and brain-on experiences‟ to teach biology.

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 (Daba, 2016). As the above researches shows that a teacher in developing country does not perform practical activities in the classroom because of different reasons even if they understand the role of practical work to enhance students' attitude towards the subject. In diaspora secondary school learners enthusiasm for science subjects becomes lower and there achievement also, as different scholars saying science teaching is effective when it supported by practical activity. But as my observation science teachers in diaspora secondary school mostly use traditional teaching methods. That is why the study plan to implement practical work particularly hands on activities (experimental method) to enhance grade 9^{th} students' attitude towards the study of biology lessons.

1.3 Objective of the study

1.3.1 General objective of the study

The aim of this study is to investigate the effects of practical work enriched instruction of biology lessons on 9^{th} grade students' attitudes toward biology lessons and thair achievement. This study compared the effectiveness of the practical work enriched instruction related to osmosis and diffusion with 1^{st} principle of designed instruction on 9^{th} grade students' achievement and attitudes toward biology.

1.3.2 Specific objectives

1 To examine how practical work that affect learners attitude towards the study of biology.

2 To improve the implementation of practical work in laboratories to enhance learners' attitude towards biology.

3 To assess how learners attitude enhance their achievement.

1.3.3 Research questions

The study will address the following research questions:

1. How does practical work affect learners' attitude towards biology?

2. To what extent the implementation of practical work improve the students' attitude?

3. How does attitude of learners relate to their achievement in the subject?

1.4 Significance of the study

The findings of this study will help:-

- All the interested parties in understanding the factors within the learners themselves and how the learners ultimately can contribute to their own learning processes and performance in the subject

- Exposing some of the perceptions and beliefs which learners acquire and carry into the classroom environment and which are of paramount importance to all stakeholders in education in attempting to improve teaching and learning of the subject in all schools.

- Provide crucial information to curriculum planners that will guide in the designing policies and strategies towards improving attitude as well performance in the subject. The teacher will understand the learners better so as to capture their attention and change their perceptions and attitude towards the subject. Motivation, reinforcement and relevant instructional strategies by the teachers, may help the learners get directions on what is expected.

- The learners will understand themselves and that their performance in the subject is a consequence of their actions, attitudes and effort which they can control for their successful learning and improvement in the subject.

- The school administration will understand what is ailing the subject and will help in putting up policies towards an enabling learning environment and providing necessary support and will be able to put up mechanisms towards improved teaching and learning of the subject.

- The study will also be useful to other researchers in supplementing the existing literature on the same study area and will also provide a rich ground for further research based on the gaps left out by this study.

1.5 Delimitation of the study

The study delaminated on the effect of practical work on students' attitude towards the topic and achivement on the study of biology. Geographically, this study was carried out in Diaspora secondary school, in Bahir Dar city, the capital of Amhara National Regional State in Ethiopia. The proposed study was based on a public secondary schools in Bahir Dar city, majority of student coming from the same social and economic background. The schools selected had adequate subject teachers, facilities and conducive environment which could allow for investigation of other factors affecting

performance in the subject. Several researchers reveals a variety of factors known to influence learning and achievement in the subject. But this study focused on the effect of practical work specifically on student attitudes concerning the subject as this has never attracted enough attention from all stakeholders in education sector.

1.6 Limitation of the study

One major limitation was the lack of experience of the researcher at such level of inquiry. The region has quite a number of both public and private secondary schools. For practical reasons, the study focused only one public secondary school due to the fact that the schools enjoy the same fee funding and subsidies from the government. This is because of limitation of resources and time. Lack of similar locally carried our researches was another limitation. In addition, this study focused on the topics of osmosis and diffusion; more key concepts should be researched in order to obtain a more comprehensive picture regarding the implementation of educationally effective practical activities.

1.7 Operational definition of terms

Achievement -The act of applying cognitive, affective, and psychomotor knowledge and processes in the completion of a learning task. It is dependent on learning objectives of the lesson.

Practical work-Implementing hands on activities to improve the teaching learning process and students' attitude towards the subject.

Attitude- is part of the moral side of pupils' personality. In this case the subject may have a positive or negative attitude towards the object. It shows on his face or it is expressed by his behavior in school

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter elaborates the current theoretical and empirical academic literature related to this research. First of all, an overall introduction of the concept of practical work and how it affects their attitude and achievement will be presented. Second, information on diffusion and osmosis and attitude of students to a subject matter will be discussed. Then an attempt to review practical work by contextualizing it to Ethiopia will be made. For this purpose, literature review of previous empirical research is presented. Finally, a summary of these previous research is made.

2.1 Introduction

Education in general and science education in particular, is important for developing methods and standards of living. The development of a society without science education is unimaginable. Scientific knowledge depends on evidence. The acceptance of knowledge achieved through science education is high because of its practical dimension and application; hence priority is given to science education all over the world (Banu, 2011). The close interdependence of the two main aims of science education are improving students' scientific knowledge and their knowledge of science as a form of enquiry and has led many science educators to argue that science education should combine and integrate them into a 'seamless' whole. The idea is that students are taught to carry out their own scientific enquiries and so acquire scientific knowledge for themselves (Millar, 2004). Accordingly, science education has two main aims: (1) helping students to gain an understanding of science content knowledge according to their needs, interests, and capacities, and (2) developing students understanding of the methods of achieving this knowledge (Banu, 2011). The incorporation of problem-solving method into science learning improves the performance as well as the attitude of students with high ability than their counterparts with low ability (Fatoke, 2014).

Practical work is a key factor in engaging, enthusing and inspiring students, thus stimulating lifelong interest in science. High quality, appropriate practical work is central to effective learning in science (biology, 2010). Practical work is defined as "learning experiences in which students interact with materials or with secondary sources of data to observe and understand the natural world." (Lunetta, 2007). Practical work in literature has been referred to in different ways: ‘experimental work; scientific investigations (Ramnarain, 2011), ‘practical and investigative activities’ (Score, 2008), and ‘laboratory investigations (Kibirige & Tsomago, 2013).

Attitude towards education is a well-known common factor to all for academic achievement (Das, 2014) . This can partly camouflage students’ attitudes because science is not viewed as homogenous subjects Students’ attitudes toward science significantly alter their achievement in science (Hena, 2016). Many students think science (biology) is difficult and seem to have an increasingly negative view for it year by year. There is a concern that students might be gaining knowledge from biology classes but are unable to relate the knowledge to themselves or to real life (Suzuki, 2007).

Practical work in science generally involves ‘hands on’ activities where learners are supposed to follow laid down procedures to arrive at a predetermined outcome. This approach most likely lead to students working on practical activities without much thought of the actions, thus resulting in poor achievement in science at the end of their study (Hinneh, 2017). In another word Practical work is necessary for school science education. In science, learners do practical work to expand their knowledge in an attempt to understand the world around them (Lemish, 2011). Practical work being accorded a pivotal role in science classrooms, the poor quality of conducting practical work in biology classroom leads students to develop certain undesirable attitude towards practical as well the subject work (Hinneh , 2017).

2.2 Diffusion and osmosis

Diffusion is the net (overall) movement of particles from an area of high concentration to an area of lower concentration. Concentrations a way of measuring how much (how many particles) of a substance is in one place. Diffusion takes place because of the random movements of the particles of a gas or of a substance in solution in water. All the particles are moving and bumping into each other and this moves them all around. Although the molecules are moving in both directions, there are more particles moving in the area of high concentration, and so the net (overall) movement is away from the area of high concentration towards the area of low concentration (Fullick, 2010). Partially permeable cell membranes allow water to move across them. It is important to remember that a dilute solution of (for example) sugar contains a high concentration of water (the solvent) and a low concentration of sugar (the solute). A concentrated sugar solution contains a relatively low concentration of water and a high concentration of sugar.

Osmosis is a special type of diffusion where only water moves across a partially permeable membrane, from an area of high concentration of water to an area of lower concentration of water (Fullick, 2010). The difficulties students have in understanding the phenomena of diffusion and osmosis can be associated with student characteristics (state of development of the scientific mindset, prior knowledge, etc.), many of them can be attributed to teaching practices, particularly with regard to management of the scientific process (Abdelkrim, 2016). According to Kibirige (2014) ,on the study secondary school students misconception on osmosis and diffusion examine secondary biology students, non-biology and biology majors continue to have misconceptions about diffusion and osmosis. The identification is of direct relevance for secondary and college biology teachers knowledge of learners misconception can be used to develop instructional approaches to hopefully correct these misconceptions.

2.3 Students' attitude towards biology

Biology lessons are interesting, not difficult, but still important (positive attitudes)(Prokop, 2007). Nigerian secondary school students have positive attitude towards science lessons (Sakariyau, 2016). Slovak students have also a positive attitude toward biology lessons and biology lessons were most popular among younger students and girls (Prokop , 2007). There is a positive relationship between students' attitudes towards learning and their academic performance. When learning is able to provide interesting activities for students and the way those activities are engaged, and even the participation of students in school decisions have influence on how students feel about learning and how they react to school life (Amir, 2016). While more Greek students carry a negative view about biology 26.4% of secondary school students are not interested in biology, in contrast to 32.8% of them are interested. Due to intrinsic motivation to learn biology, interest in biology and perceived difficulty of biology and students' views about the way biology is taught (Evangelia, 2012).

2.4 The status of practical activity in Ethiopia

According to Daba (2016) study the status of biology practical activities in secondary and preparatory schools in Ethiopia and the result showed that 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. There was inadequate availability of instructional materials (laboratory equipment's) in Wolaita and Dawuro Zone secondary schools. This result indicated that most laboratories in secondary schools are not performing their laboratory activities based on objectives set on the curriculum (Ashebir, 2016). Finally, practical-based education is not efficient in almost all of the schools under study. Only computer laboratories and sport fields were occasionally active (Adugna, 2017)

2.5 Importance of practical work in science

Main aim of using practical work is to enable students to observe an object or material or event or phenomenon, to note some aspects of it, and perhaps be able later to recall these. This is often a necessary precursor for one or more of the other objectives listed. A fact simply means a 'quickly decidable sentence (Millar, 2004). They suggest that the learner must play an active role in 'taking on' the new scientific knowledge. He or she has to 'make sense' of the experiences and discourse of the science class, and use it to 'construct meaning'. Practical work develops learners' understanding of ideas, theories and models Stimulates creativity, curiosity and critical thinking

• Underpins and illustrates concepts, knowledge and principles

• Promotes student engagement with the scientific method

• Encourages active learning and problem-solving

• Allows collaborative working

• Provides opportunities to collect and analyze data and apply mathematical skills.

According to Kiberg (2014), practical work has a significantly positive effect on learners' performance. They found this in their study of the Effect of Practical Work on Grade 10 Learners' Performance in Science in Mankweng Circuit, South Africa. They designed quasi-experimental method on 60 grade 10^{th} science learners. The results show that practical work has a significantly positive effect on learners' performance. Moreover, practical work found to be

- Essential component of science teaching and learning,
- Aims to develop students' scientific knowledge is best seen, and judged, as communication

rather than as enquiry.

- Develop students' scientific knowledge often requires students to make links between two domains of knowledge.

- More open-ended, investigative kind can develop students' tacit knowledge of scientific enquiry (Millar et al, 2004).

Absence of any practical activity in science subjects due to laboratory facilities have influence on students score in science and their future study (Seid, 2016). In addition to this implementation of instructional congruence in teaching science has the significant effect in improving students' interest towards science, especially in the aspects of practical work of science (Ahmad, 2010). Laboratory activities in science fields are paramount relevant to make science learning more practical and observable to internalize the theoretical knowledge about natural processes and phenomena. Generally as the above researchers indicated that if the amount of practical work increases the quality of science subjects, students' view of science and students' achievement will increase (Ashebir, 2016).

2.6 Factors hindering practical activity in Ethiopia

According to Tolessa & Mohammed (2016), the following gaps observed in secondary and preparatory schools in Ethiopia. Allmost all secondary and preparatory schools have common laboratory, schools laboratory is not equipped and chemicals which are even important to small extent are missing. There is no facility except Awash and Aba'ala secondary schools in which there are some facilities but laboratories are not functional and equipment and chemicals are simply stored in non-ventilated store due to absence of skilled laboratory technicians and cooling system in schools under study in some area of afar region, Ethiopia. Similarly poor standards of laboratories and design

in the school, the existence of one common laboratory room for all sections (grade 9-12 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 and others in Wolaita zone, SNNPR, Ethiopia (Ashebir , 2016). In other word lack of awareness and motivation of school managements to practical work is the major factor that influences practical work in chemistry, the full-time occupancy of chemistry teacher, low commitment of teachers for the practical classes, absenteeism of teachers "from practical class, teachers poor knowledge about practical work and low qualification of chemistry teachers are influencing practical work in chemistry of secondary schools in Wolita zone (Mathewos, 2016). Similarly there were limitations in doing practical activities in both theoretical and practical classes with regards to the teaching equipment, class sizes, and the time-length and also the timing of practical classes. Teachers also thought that practical classes were sometimes hampered due to the lack of awareness of school administration and also due to the negligence of some science teachers and head of teachers' secondary school physics in Bangladesh (Banu , 2011). Additionally, there appeared to be no training programs devoted particularly to teaching practical classes. In case of diaspora secondery school laboratory roms, facilitise and the situations are avelable but teachers use the usual teaching method rather than active teaching method even if they frequentlly take trannings incress thaire capacity.

2.7 Practical work, students' attitude and achievement

An interest in Biology influences performance because it provides the drive within students to participate in learning process. Good attitude and better interest learners display particularly in Biology serve as an encouragement even to the teacher (Owino, 2015). Practical work has a significantly positive effect on learners' performance (Israel, 2014).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 in afar region 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 (Tolessa, 2016).

According to Ozlem (2011), study the effect of hands on activity enriched instruction on students' achievement and attitude towards science on 6th grade students in Ankara, Turkey. The study was conducted to find answer for two research questions that are what are the effect of hands-on activity enriched instruction and traditional instruction on 6th grade students' science achievement and what are the effects of hands-on activity enriched instruction and traditional instruction on 6th grade students' attitude toward science. And another researcher (Lizabeth, 2012) studied the effect of laboratory based activities on students' attitude towards science on 5th grade students at Radley Elementary School in East Helena, Montana. The study aimed to examine the impact/effect of activity-based activities on student attitudes toward science based on the following three research questions that was how students learn science best, what students like about science, and how their understanding of science has been affected by labs and experiments. And the other researcher (Kayani, 2017) in his study titled Improving Students' Attitude towards Biology as a School Subject: Do the Instructional Models Really Work? In District Rawalpindi, Islamabad. This study aimed and designed to compare the effectiveness of 7E Instructional Model with Traditional Instructional Model on students' attitude towards biology as a school subject. (Ozlem 2011) use quasi experimental design and she use three measuring tools that was science achievement test(SAT),science attitude scale(SAS)and Observation Checklist for both the treatment and controlled group as instrumentation both groups thought for three week. Both hands-on activity enriched instruction and traditional instruction lasted about three weeks of second semester of school. The science course consisted of three 40-min lessons per week to teach the topic sense organs. The

students in the control groups and the experimental groups treated with different methods of teaching. And (Lizabeth , 2012) use an action research to study the effect of activity based instruction on students' attitude towards science for 5 months. The study use Interview to determine their general attitude about school, their favorite subject, and what they liked best about science. And (Kiyian , 2017) in their study used quasi experimental method and implement Pre-test & post-test for randomly selected experimental and controlled group. The total number of participants in the study was 122 [sixty girls and sixty two boys]. The researchers used two standardized research instruments for this study after taking permission of the authors. Biology Attitude Questionnaire (BAQ) developed by Prokop in 2007 and Integrated Science Process Skills Test (ISPST) developed by Monica in 2005 similarly with (Ozlemi,2011).But(Kayani , 2017) does not use observation checklist as an instrument.

(Ozlaim , 2011) find the following results from her study on 6th grade students in Istanbul experimental group shows a mean increase of 8.61 whereas the change of control group is 4.25 points on the SAT which indicates that the students in the hands-on group performed overwhelmingly better score than the control group students. Although the experimental groups' scores showed mean increase of about 2.12 points in their science attitude scores from pretest to posttest, the control groups' scores showed mean increase of about 0.86 points from pretest to posttest scores. The results of this study showed that hands-on activity enriched instruction increased students' achievement in science more than the traditional instruction did. Similarly, (Lizabth , 2012) in her action research on 26 5th grade students in Helina Montana find fifty-six percent of the students reported that they liked labs or experiments best. After treatment results at the end of the treatment indicated that 77% liked science best. And 88% of the students said that what they liked best about science was the labs. The treatment continue for five months and evaluation continue at every quarter. Finally, the research conclude when No of practical activity increased attitude of learners also increased. While Kiyian ,

2017) in study improve students' attitude towards biology as a school subject do instructional model really work? The study find students' attitude regarding biology was sought using Pre-BAQ for understanding meaningful change existing in the participant groups of the study in the perspective of students' attitude towards biology. Later on, significant difference was witnessed in the students when Post-BAQ responses of the ones who received instructions based on the 7E Instructional Model and those who received instructions based on the Traditional Instructional Model, were examined. The 7E Instructional Model was found better than the Traditional Instructional Mode. Because pre-test scores in BAQ control groups ranged from 30 to 56 with evident mean of 39.11 while, experimental groups' scores ranged from 30 to 56 with evident mean of 41.52 and post-test scores of BAQ were also analyzed using descriptive statistics. It was witnessed that in control group the said scores ranged from 40 to 60 with evident mean of 48.38. Moreover, in case of experimental group the scores ranged from 41 to 64 with evident mean of 52.00.

2.8 Strengths and weakness of the above studies

According to Ozlemi (2011), to study the effect of hands on enriched students' attitude and achievement on science subject of 6^{th} graders. And researcher train teachers who teach both the experimental and control groups this may affect validity and reliablity of the study because individual teahers has defferent capacity to teach, so it was better to performed by the researcher. Similarly, (Kiayan, 2017) use quasi experimental method to study the effect of 7E instructional model on 9th grade students biology lessons particularly environment by comparing with traditional instruction. And the study control other variables. While (Lizabeth, 2012) use an action research to investigate the effect of laboratory based instruction on students' attitude on science on 5th grade students for 5 months. The study treat students by frequent use of experiment and assess students progress by employing interview for participants this my reduce validity of the study because only one research

instrument used by researcher that was portfolio. While (Ozlemi ,2011) use SAT, SAS before and after treatment and use observational checklist this increase reliability of the data. Similarly with (Ozlemi , 2011) (Kayani , 2017) use BAQ and ISPST both for control and experimental groups this may increase validity of the study.

2.9 Conceptual Framework

What are some guiding principles of constructivist thinking that we must keep in mind when we consider our role as educators? Few ideas on constructivist learning theory, all predicated on the belief that learning consists of individuals' constructed meanings and then indicate how they influence education. Hein (1991) provided the following points in this regard:-

- Learning is an active process in which the learner uses sensory input and constructs meaning out of it. Learning is not the passive acceptance of knowledge which exists "out there" but that learning involves the learners engaging with the world.

- People learn to learn as they learn: learning consists both of constructing meaning and constructing systems of meaning.

- The crucial action of constructing meaning is mental: it happens in the mind. Physical actions, hands-on experience may be necessary for learning, especially for children, but it is not sufficient; we need to provide activities which engage the mind as well as the hands

- Learning involves language: the language we use influences learning.

- Learning is a social activity: our learning is intimately associated with our connection with other human beings, our teachers, our peers, our family as well as casual acquaintances, including the people before us or next to us at the exhibit.

- Learning is contextual: we do not learn isolated facts and theories in some abstract ethereal land of the mind separate from the rest of our lives: we learn in relationship to what else we know, what we believe, our prejudices and our fears.

- One needs knowledge to learn: it is not possible to assimilate new knowledge without having some structure developed from previous knowledge to build on. The more we know, the more we can learn.

- It takes time to learn: learning is not instantaneous. For significant learning we need to revisit ideas, ponder them try them out, play with them and use them.

- Motivation is a key component in learning. Not only is it the case that motivation helps learning, it is essential for learning

2.10 Summary

The above three studies find the effect of practical activity enriched instruction, activity based instruction and 7E instructional models to enhance learners' attitude and achievement towards

science as well biology on different grade labels and context. The study of effect of practical work to enhance the attitude of students towards biology and achivement different from the above three studys by using design besed reserch design insted of quasi expermental method and action research. And most similar with(Özlemi,2011) study by using three research instruments BAQ, BAT befor and after treatment and use intervew insted of observational checklist. And the study of the effect f practical work on the attitude of students on biology lessons and achivement select 9th graders similarly with(kayani , 2011) but seelect the topic osmosis and diffusion instade of environment. Finally the study defferent from those three studys by the context and sample size.

According to Mohd (2013), that there is a significant association between students' achievement and students' attitudes towards academic subject. Accordingly, the study the effect of practical activity to enhance the attitude of students and achievement towards biology lessons particularly osmosis and diffusion on a case of diaspora secondary school use design based research was employed differently from (Ozlem, 2011; Lizabeth, 2012 and Kayani, 2017). While this study will use three instrumentations the biology attitude test, biology achievement test and students interview to increase validity. Similarly (Ozlem , 2011) used interview of participant students for triangulation. And simple random sampling to select 9^{th} E student participants and will implement on 9^{th} grade biology learners similarly with (Kayani , 2017).

CHAPTERTHREE

METHODOLOGY

This chapter presents research design, sources of data collection method, sampling design, data analysis method, ethical considerations' and intervention plan.

3.1 Research Design

The design considered appropriate for this study was experimental design since the aim of this study is to assess the effect of practical work on attitude and achievement of grade 9^{th} students towards biology lesson. Hence, data regarding students' attitude and achievement was collected before and after the experiment. Assessing learners' attitude towards the subject from all participants' requires the use of quantitative and qualitative data. Thus quantitative data was obtained from experiment and qualitative data was obtained from interview of sample students.

For this purpose, one topic was from the students' text book- cell and its environment (osmosis and diffusion)- was selected before intervention. Then, plan was developed on how to teach the topic- cell and its environment- practically (by selecting appropriate practical activities to teach specific topics that found under the cell and its environment). The study used principle of instructional design (problem based learning) to plan the lesson, i.e., by giving the whole task problem for students before starting the lesson and using materials found in the environment to perform selected practical activities. Intervention was then made. Then assessment about the effect of practical activity to enhance students' attitude towards biology and their achievement level was conducted.

3.2 Source of data and collection method

Primary data was used for this research. Students of grade 9^{th}E in Diaspora secondary school were the sources of data. Data before intervention and after intervention was collected regarding the students'

attitude towards biology lesson and their achievement. Sequential mixed methods data collection strategies involve collecting data in an iterative process where by the data collected in one phase contribute to the data collected in the next. The data was gathered primary using questionnaire (attitude questions) developed by (Pavlo P. 2007) and modified by the researcher and achievement test developed by the researcher, that contain 10 multiple choice questions. The questionnaire was distributed for 59 students of grade 9^{th}E Interview with four students was also conducted to collect qualitative data.

3.3 Sampling design

All grade 9^{th} students taking biology course at Diaspora secondary school were the target population. Simple random sampling was used to select F = 23 M = 26 T = 59 grade 9^{th} E students from the total of F = 223 M = 205 T = 482 students. A list of all grade 9 students was obtained a lottery method was applied to select the sample respondents for intervew.

3.4 Data analysis methods

The data so collected was analyzed by using different methods. Data from the questionnaire was analyzed using the help of SPSS software. Descriptive data analysis, correlation and paired sample t-test were used in analyzing data. Paired sample t-test was used to compare the results before and after intervention. Paired sample test is used to compare groups that are related in some way. The data from the interview was analyzed by inserting it in its appropriate place. It was used to reinforce the data analysis from the questionnaire.

3.5 Ethical considerations

Consent letter was written from Bahir Dar University to the concerned secondary and preparatory schools. Before disseminating questionnaires' to students and teachers, formal permission was taken

from the informants. And confidentiality was adhered to throughout the study; this was done by informing teachers and students not to write any form of identification on the questionnaire papers. As there was no need for the study to identify any of the students or the schools involved in the main study, everything was kept anonymous. During the interview no names were recorded and pseudonyms were used at all times to ensure anonymity

3.6 Intervention plan

The intervention was made in three phases.

Phase one: in this phase data was collected about students' attitude towards biology. This data was intended to be used as a base line data before intervention so that whether the intervention would bring about change in attitude and achievement. Train teachers on factors affecting students' attitude; on how to enhance students' attitude; on active way of teaching strategy and on first principle of instructional design to help students' active learning of biology lesson in diaspora secondary school.

Phase two: Assess students' current attitude towards biology particularly the topic osmosis and diffusion and their level of achievement before intervention. Plan to teach osmosis and diffusion and prepare hypothetical learning material using 1st principle of instructional design. Implement the plan and assess learners over all activity during implementation to compare with the traditional way of teaching. During implementation collect data from participant students by using attitude questions, intervew, and assesing participants achivement differens befor and after tretment. Evaluate learners' attitudinal change after intervention by using the data collected during HLT and there achievement also after intervention.

Phase three (Retrospective analysis): Data analysis in these study follow two main steps. These are a task oriented analysis and a more overall analysis .The first is to compare data on students' actual learning during the different tasks with the HLT. And finally prepare the final report of the study.

CHAPTER FOUR

RESULTS

This chapter presents the data presentation section of the study. The data collected for the research is presented using different methods such as tables, correlation, t-test etc. First, the descriptive statistics of the variables are shown. The data on attitude of students' pre and posttest is presented. After that, the correlations between the variables are discussed. Moreover, data from the interview was used to reinforce analysis data obtained using questionnaire.

4.1 How does practical work affect learners' attitude towards biology?

Table 1: Descriptive statistics of the data collected

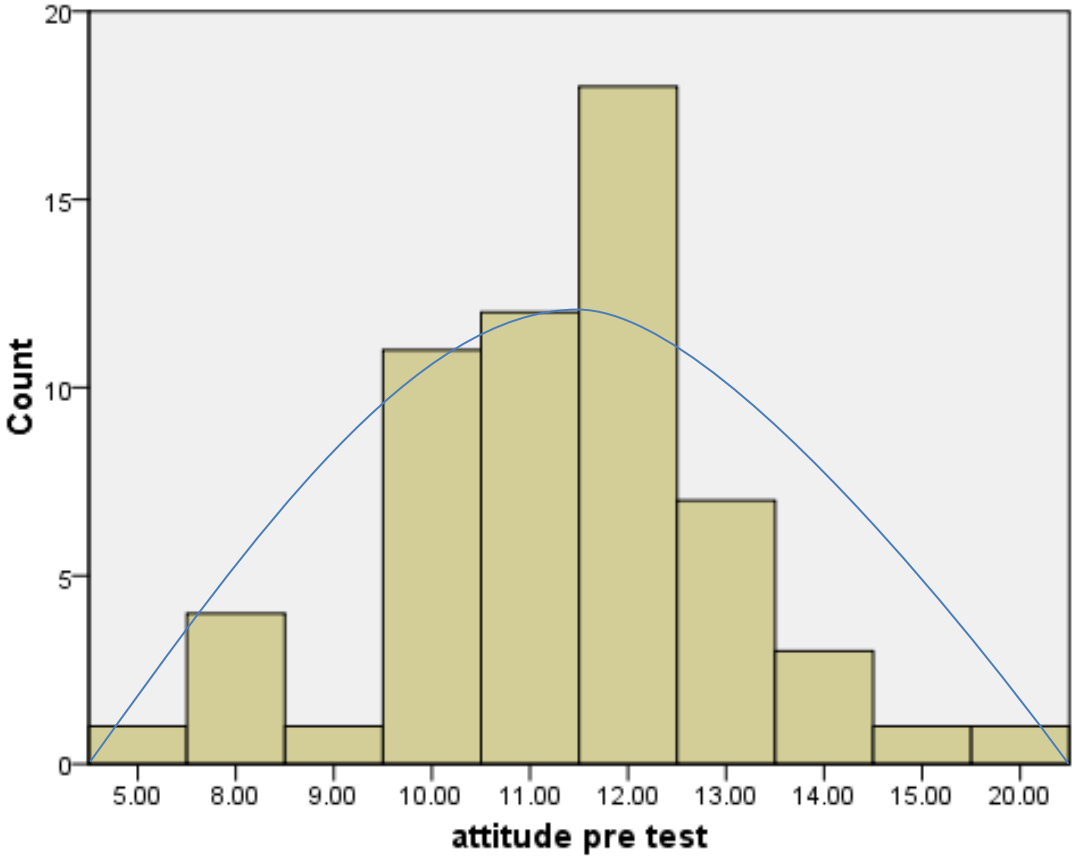
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Attitude pre test	59	5.00	20.00	11.39	2.06	.62	.31	5.33	.61
Attitude post test	59	10.00	22.00	15.05	3.14	.60	.31	-.62	.61
Achievement pre test	59	.00	7.00	4.10	1.61	-.83	.31	.89	.61
Achievement post test	59	4.00	10.00	6.7458	1.39	.55	.31	.40	.61
Valid N (list wise)	59								

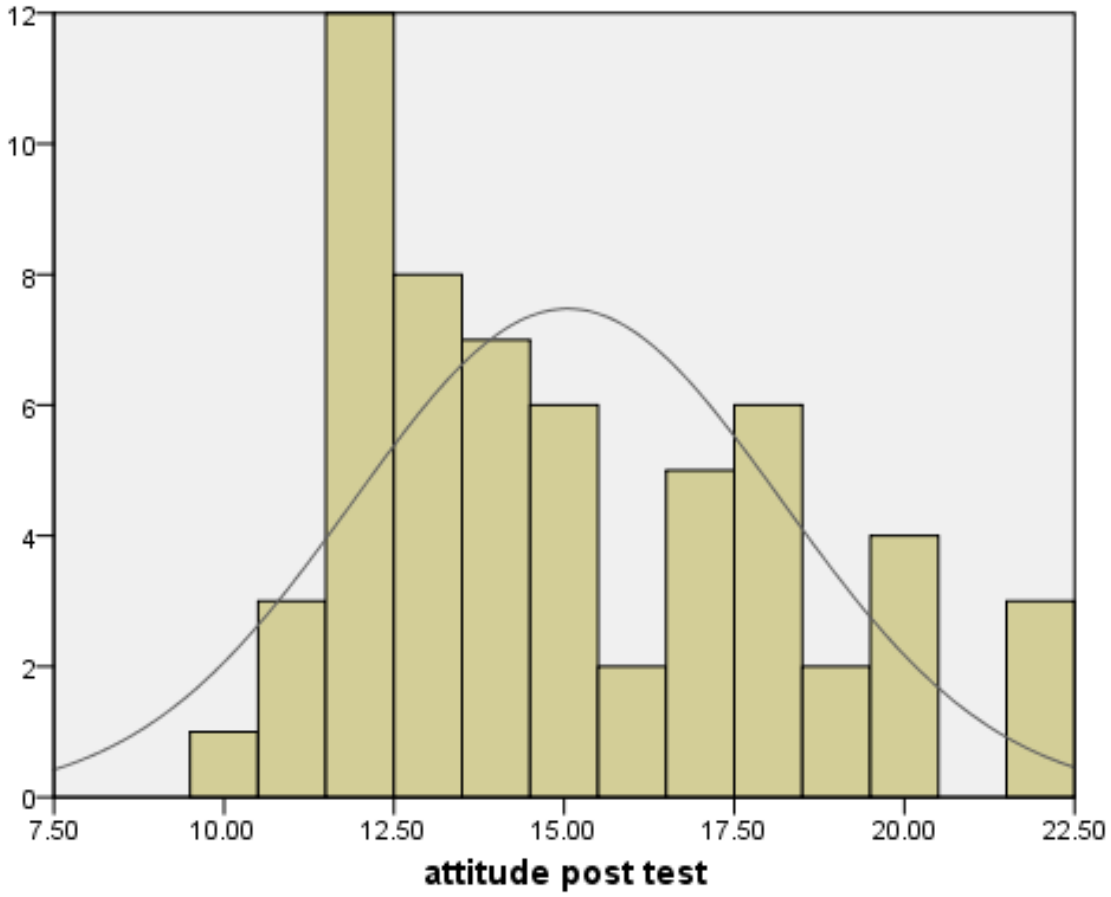
Figuer 1-The above table shows the descriptive statistics of the sampled students. It shows measures of central tendency, variation and shape. Thus the pre and post treatment scores are presented in terms of minimum, maximum, average, standard deviation, skewness and kurtosis. Looking at the pretest- attitude, the minimum value and the maximum value are 5 and 20 respectively. The average score is 11.39 where as the standard deviation is 2.06. The

post- treatment, minimum, maximum, average and standard deviation scores are 10, 22, 15.05 and 3.14 respectively. It is, therefore, possible to conclude that there is an improvement in the attitude of students towards lessons in biology. The variation in the scores of students is relatively small as measured by standard deviation.

The graph shows participants attitude pre test resalt



The graph shows participants attitude post test results



A similar conclusion can be drawn about students' achievement after treatment. As can be clearly seen from the data in table 1, the average score of students' achievement increased from 4.10 pre-treatment to 6.74 after treatment. Moreover, the variation in achievement of students is relatively small measured by both range and standard deviation. Accordingly, the minimum and maximum achievement score are 0 and 7 pre-intervention and 4 and 10 after-treatment. The standard deviation of achievement has decreased from a pretest value of 1.61 to 1.39 after-treatment. The possible generalization from this is the intervention has resulted in to improvement in the achievement of students.

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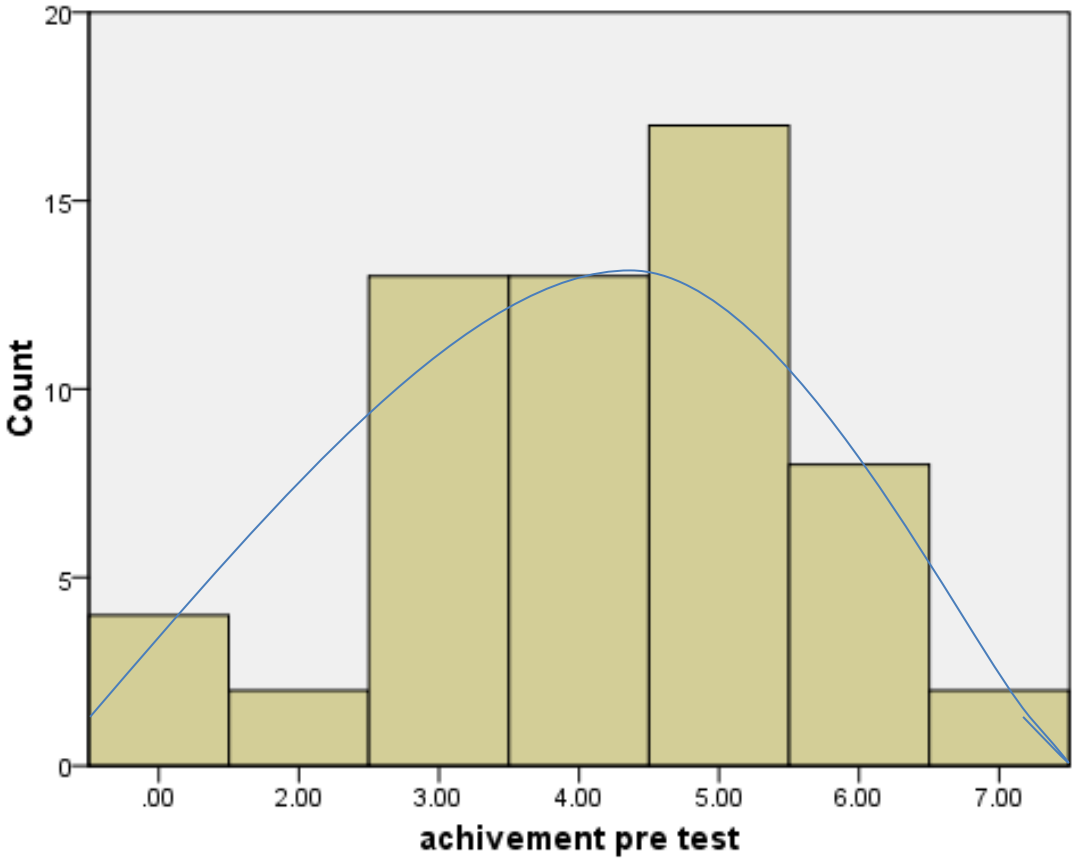
The graph shows achivement pre test results of participants



The graph shows achivement post test results of participants

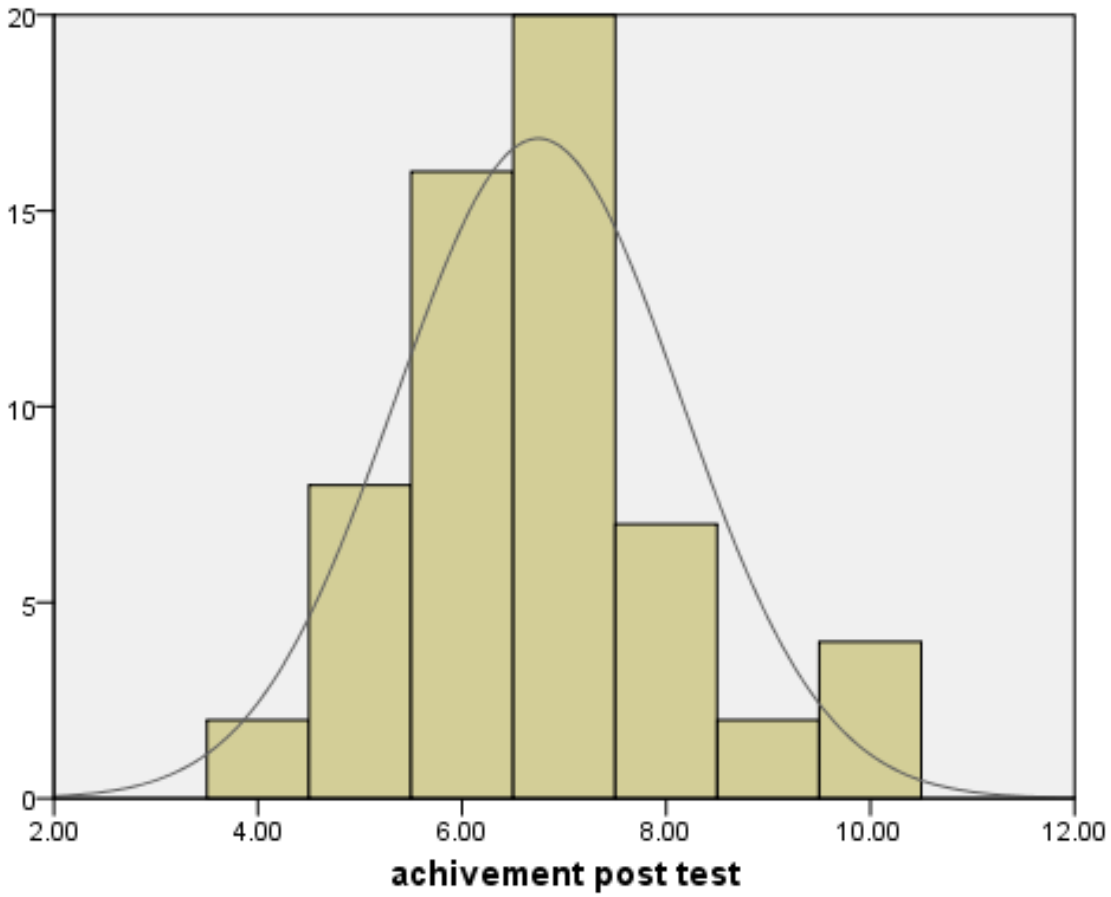


Table 2 presentation of attitude test

shows the responses of questions asked to find out about the pre-intervention and post-intervention attitude of students' towards the lessons in biological science especially diffusion and osmosis. The table below presents the tewenty questions asked in this regard.

Table 2- presentation of attitude question with its discriptive statstics found in the appendix(see appendix A)

Figuer 2- According to the responses of the sampled students to the first question, liking towards biology has shown significant increase after the intervention. Specifically, it has increased from 36% liking before intervention to about 87% liking after intervention. This

can be considered a huge boost towards in liking towards biology lessons resulting from practical work. The second question was aimed at knowing if students are strangers to nature and biology. Even before the intervention, about 95% of the sampled students responded that they have not been new to both nature and biology. This is probably because they have been exposed to different aspects of the subject at lower grades and the treatment did not make a difference in this regard. The other question asked was if the students prefer to have biology lessons more often. The data shows that the students appetite for more frequent lesson in biology slightly declined from a before treatment percentage of about 73% to an after treatment percentage of nearly 86%. This is a clear evidence that biology lessons with practical work are so effective that the students understand whatever they are taught. Hence, there is no need for taking lessons repeatedly.

Another issue of interest to this study was to find out about how interesting is using living organism in biology lessons. The students' affirmative response to the question increased from about 86% to 92% before and after intervention respectively. From the data, therefore, it is possible to conclude that the intervention has slightly increased the interesting nature of using living organisms in biology lessons. Though a small percentage, the students' belief in the relevance of biology in their future life has shown improvement. This is evident as the percentage of agreement to the question relating to future relevance of the subject increased from 93% before treatment to 97% after treatment. Moreover, the students' reply to the question of whether their future is independent from biological knowledge strengthens the above assertion. About 93% before intervention and 97% after intervention disagreed that their future is independent from biological knowledge.

Even if the magnitude is relatively small, there is a twofold improvement in considering biology teachers as personal models. Looking up to the biology teachers as role models was only 15% but increased to 32% after the treatment. This has definitely something to do with the practical nature of the subject delivery. Obviously, considering someone as a role model or not is a function of many factors. Teaching biology with laboratory work and other practical issues is just one factor. This probably why a huge percentage of respondents disagreed to the question. On the same logic, there is an improvement in students' aspiration to become a biologist after the intervention. The ratio of students who aspire to become biologist increased from just 17% to 24%. This 5% improvement can be attributed to the intervention even if aspiration of students are shaped by many factors.

The sampled students were asked some questions to understand how biology shapes their conceptual skills and understanding of other subjects. For example, nearly 92% of the respondents' agreed that biology helps to develop their conceptual skills. This represents a 7% increase from a before treatment proportion of 85% who replied positively to the question. The respondents were also asked to compare the importance of biology with other courses. Regardless of the intervention, about 92% disagreed to the statement that biology is not important compared to other subjects. This means most students believe that biology is an important subject to study. Further, most students are of the opinion that the study of biology is essential in understanding other courses and phenomena. As it is evident from the responses, after the intervention a staggering 93% agree that biology is important for comprehending other subjects and events where as this figure was about 90% before the intervention. Further, the students' disagreement to the proposition that nobody needs biology knowledge is an indication that not only they believe in the importance of biology but also trust that it helps in understanding of other subjects and phenomena. A very general question that aims at finding out about if the respondents believe that progress in biology improves

quality of life was asked. Before intervention, about 86% agreed that progress in biology improves quality of life and this figure grow to 93% after intervention. Even if the difference the intervention has made is relatively small, the 93% is a huge proportion. Thus, based on this data, it is possible to claim that teaching biology effectively and improving students understanding has far reaching consequences. It has a power to affect the quality of life of students.

How students perceive their teachers and the way the teachers teach has also an important bearing on students attitude towards biology lessons. Obviously, one's liking or disliking towards someone is determined by numerous factors. But whether one likes biology teachers definitely shapes his or her attitude of the subject. While about 53% liked their biology teacher before treatment, with the intervention this figure become 63% which is a 10% increase. Perhaps, a huge difference is observed in terms of making students engaged on active work. Only 10% believed that their teachers make them do active work before the treatment while 54% agreed that they were exposed to active work after treatment. This is why probably about 83% of the students think that biology is one of the easiest subjects after intervention, an improvement of about 10% from the before treatment percentage. Arguably, practical work might have made students understand the lessons and ultimately making them believe that it is easy. This is further substantiated by the data relating to the level of difficulty of understanding biology lessons. The proportion of students who think that they have problems comprehending what they have learned has reduced from a before treatment level of 63% to 54% after intervention.

In order to understand the students' attitude towards biology lessons at a deeper level, interview was conducted with students after intervention. This is to help substantiate the data from the questionnaire.

A structured interview was conducted with 4 students the experimental group. The responses obtained the interview is presented below in a summarized form.

The students were first asked to explain how practical teaching affected their understanding and your satisfaction of learning substance transportation (osmosis and diffusion) topics. The following response were obtained

- I liked it, because these scientific experiments are relevant to our daily life.
- Osmosis and diffusion lessons help us gain a better understanding of life and events.
- It had a positive impact on understanding osmosis and diffusion.
- After experiencing the practical activities (experimental teaching), I had a better understanding of the issues related to osmosis and diffusion.

The second question presented to the interviewees was what method of teaching they will implement if they choose to be a biology teacher in the future. Most of them replied they would be using a combination of both laboratory and demonstration in their teaching. The following points are obtained from their responses.

- Computer based and using a combination of laboratory with demonstrations
- Practical teaching method, because of it has positive impact on students.
- Providing examples of things that occur in everyday life to help students understand them more.
- Practical activities in the laboratory, to make students take osmosis and diffusion more seriously and to understand the importance of these topics.

The points presented in bulletins were found when the students were asked how this method affected teaching the application of biology in everyday life

- I like to try things; they make me curious about many things.
- It increased my desire to apply things in everyday life.
- It exposed me to a variety of issues and how to use science, including its dangers and its positive effects.
- It had affected me positively and led me to better understand what is happening around me in everyday life

The fourth question was “How and to what extent has this method influenced your interest in biology - What is your feeling? The students’ answers are summarized below.

- It influenced me greatly; I'm now more interested in learning science.
- The science professionals affected me very much; I love it much more now.
- My interest grew more than in the past; I feel proud to have achieved this level.
- This teaching method increased my desire to study science; I feel more comfortable because I understood it more.

Also students were inquired to reflect up on if their perception of biology has changed and how. The following are their responses.

- No serious difficulties; I still believe that the science profession is interesting and beautiful.
- Yes, my anxiety disappeared towards the science profession; learning it became easier

and more interesting.

- Yes, I like biology more and I now really want to study it.
- No, since I already had a positive perception toward science, especially biology before I learned in the laboratory (practically)

Last but not least, the students were asked if the practical teaching has affected their motivation to continue studying biology in the future? To what extent? The responses are summarized below.

- The teacher who used this method really affected me.
- I will continue to learn; maybe I'll be a teacher.
- A positive effect regarding the desire to learn and teach biology in the future.
- A very positive effect regarding my motivation leading to more satisfaction in studying science.

The responses to the above six question are consistent with the data obtained from the questionnaire. It reinforces and substantiates the fact that practical teaching affects students in many ways. It not only positively affect their interest, motivation, attraction, and understanding of lessons in biology but also helped to change their perception about science education for better. It has also helped them to apply the knowledge to their everyday life. Based on the students' responses in this interview, it can be concluded that teaching osmosis and diffusion via the practical teaching (experimental) method affected them very positively, brought these subjects closer to their hearts, made studying them easier, increased the extent of interest and attractiveness, and elevated the students' level of motivation andsatisfaction.

In addition to the students' attitude, this study has attempted to understand the views of students about the preferred teaching strategy and how they think that practical work affect learning. The following table presents data about these two issues.

Table 3- teaching strategy and effect of practical work

Items	Before intervention		After intervention	
Preferred teaching strategy	Practical	Conventional	Practical	Conventional
	49(83.1%)	10(16.9%)	54(91.5%)	5(8.5%)
How does practical work affect learning	Positively	Negatively	Positively	Negatively
	50(84.7.5%)	9(13.7%)	55(93.2%)	4(6.8%)

Figure 3- As it can be clearly observed from the table above, the students' preferred teaching strategy is found to be practical before and after intervention. Surprisingly enough about 83% of the students' preferred practical work as their learning strategy. This may be due to the fact that practical work is not often used in teaching lessons for various reasons. For this reason students might preferred to have more of practical teaching. But there is also an improvement in their preference even after intervention. About 92% of the respondents preferred practical teaching over conventional teaching strategy. Hence, practical teaching strategy is popular among the students with or without intervention. Moreover, most students believe that practical work affects learning positively. The proportion of students who think that practical work would positively impact learning has increased from 85% before treatment to 93% after intervention.

4.2 To what extent the implementation of practical work improve the students' attitude?

The differences between the pre and posttest of attitude and achievement tests following the treatment (exposure to practical activities in the experimental research were determined by a series of t-tests for the two measures (repeated measure T test) samples.

Table 4 paired sample statistics

Paired Samples Test

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Attitude pre test – attitude post test	-3.66	2.68	.35	-4.36	-2.96	-10.5	58	.000

Figure 4- shows means, standard deviations, and the t-test value for the practical work efficiency and for the importance of perception (attitude) (the group of students who had been exposed to the use of practical work in the teaching of the substance transportation (osmosis and diffusion)

To test the hypothesis that the pre – attitude test (M=11.39 SD=2.07) and post-attitude test (M=15.05 SD=3.15) were equal a dependent sample t test was performed. And paired sample t test shows (M= 3.66 SD= 2.68) and ($t(58)$= 10.48 P= .00 with DF= 58). The figure shows that extremely statistically significant difference between pre and post attitude results.

Table 5- Paired Samples Statistics

Paired Samples Test

		Paired Differences					T	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Achievement pre test achievement post test	-2.64	1.59	.21	-3.06	-2.22	-12.7	58	.000

Figure 5- shows the means and standard deviations for students' efficiency in the test administered to them before and after the experiment (intervention), and the value of the t test. A significant improvement occurred in the achievement of those students who had been exposed to practical teaching (experimentation) .To test the hypothesis that the pre-achievement test (*M*=4.10 *SD*=1.61) and post achievement test (*M*= 6.74 *SD*=1.39) were equal a dependent sample t test was performed. And paired sample t test shows (*M*=2.64 *SD*= 1.59) and (*t(58)* = 12.78 *P*= .00) this result also shows statistically extremely significant difference between pre and post achievement test results .

4.3 . How does attitude of learners relate to their achievement in the subject?

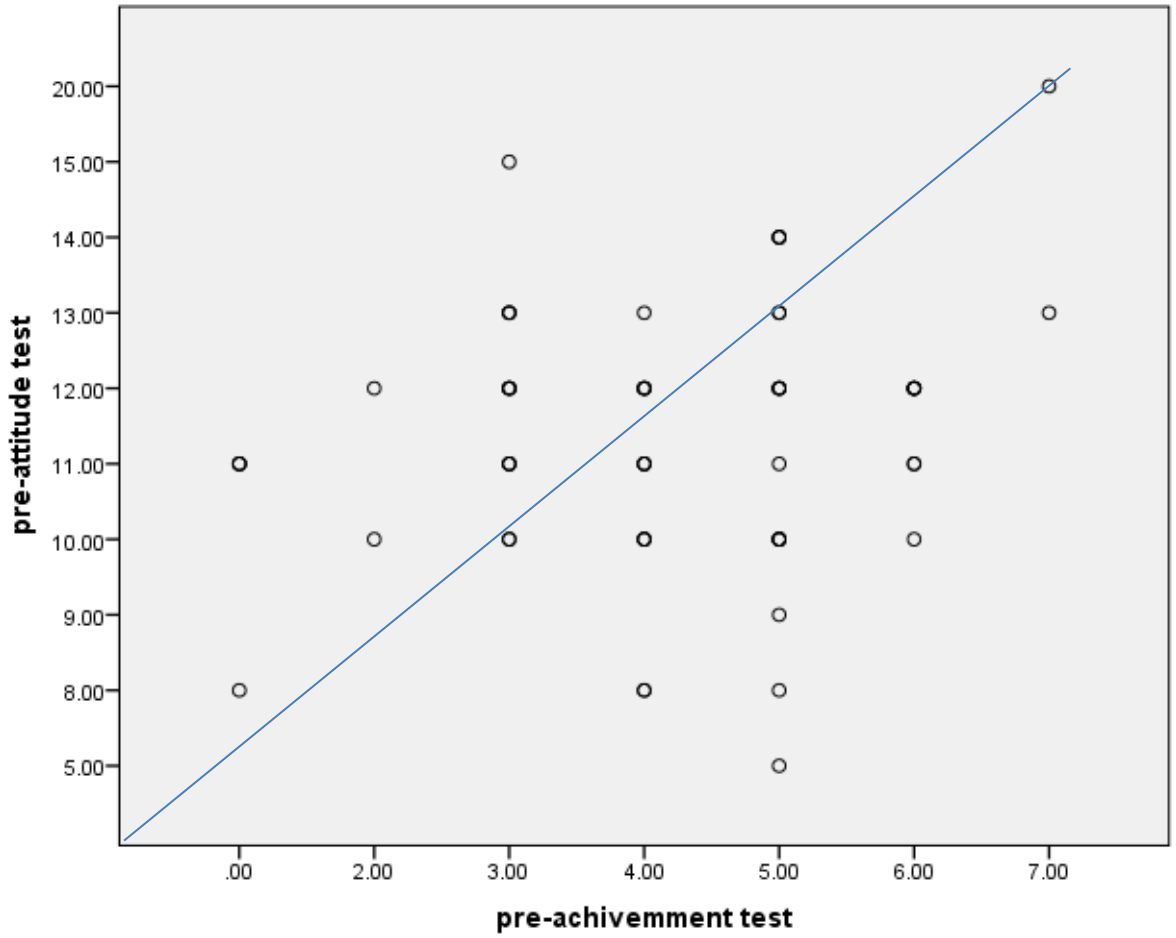
Pearson correlation test was conducted to determine the relationship between students' attitude lessons in biology and their achievement. This is done in two different test. One test is done to check the relationship between pre-test attitude and achievement and another test is conducted to determine the relation between post-experiment attitude and achievement. These tests are presented in the tables below.

Table 6- pre-test correlation

Correlations

		Attitude pre test	Achievement pre test
Attitude pre test	Pearson Correlation	1	.210
	Sig. (2-tailed)		.111
	N	59	59
Achievement pre test	Pearson Correlation	.210	1
	Sig. (2-tailed)	.111	
	N	59	59

The data in the table 6 above shows that there is a weak positive correlation between pre-test attitude and achievement of students. The Pearson correlation coefficient (r = 0.21) coupled with p=0 .11 indicate that there exists a significant positive relationship between pre-test attitude and achievement of students. However, the correlation is weak as the correlation coefficient is close to zero.



The graph shows there is a positive corrilation between attitude pre tast and achivement pre test at .21 level

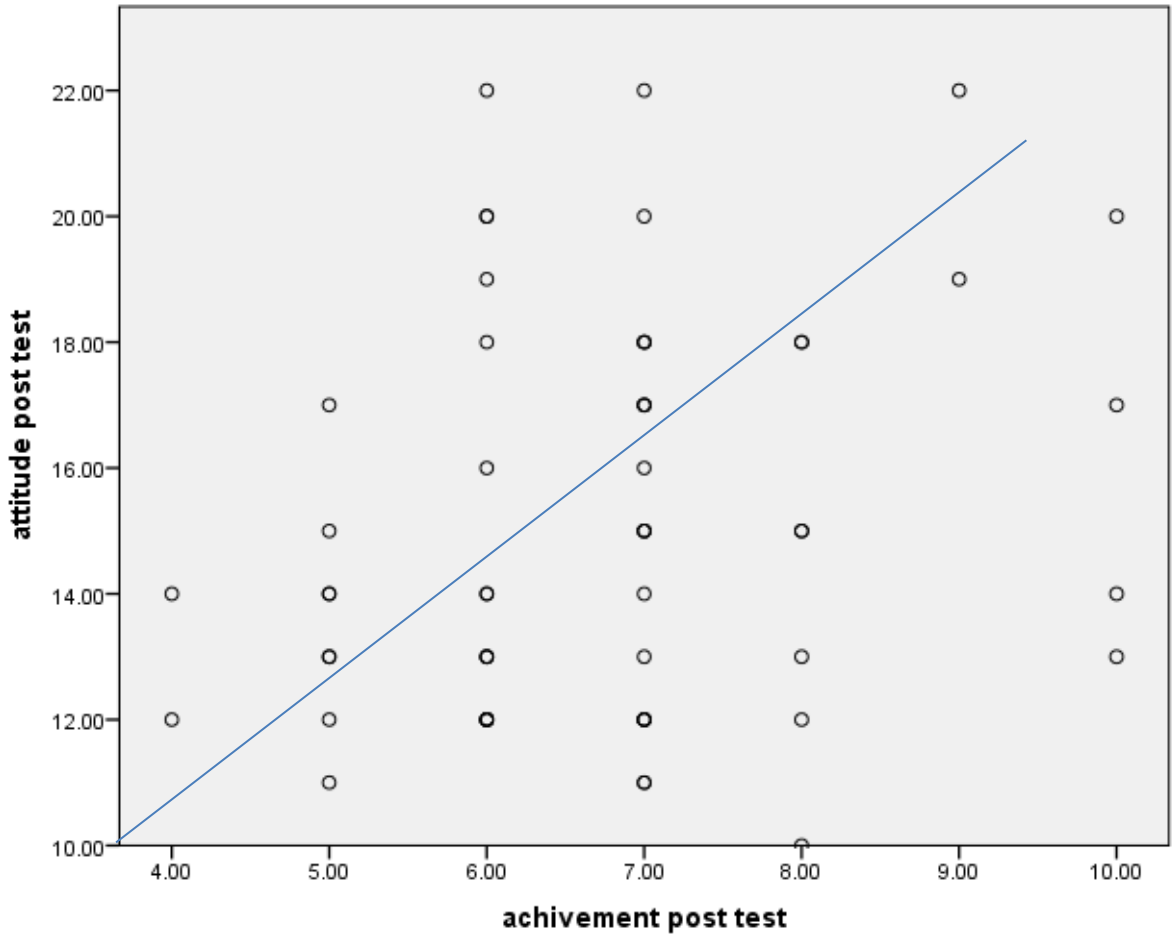
Table 7: post-test correlation

Correlations

		post- attitude test	post-achievement test
post- attitude test	Pearson Correlation	1	.246
	Sig. (2-tailed)		.060
	N	59	59
post-achievement test	Pearson Correlation	.246	1
	Sig. (2-tailed)	.060	
	N	59	59

Based on the data in table 7, the relationship between post-test attitude and post- test achievement is positive but weak. But there is an improvement in strength of correlation in the after test relation as the pre-test correlation coefficient(r=0.21) has increased to a post-

test level of r=0.246. The small p-value (p=0.06) indicate significance of the positive correlation between post-treatment attitude and achievement of students.



CHAPTER FIVE

DISCUSSION AND IMPLICATION OF THE RESULTS

This particular study attempted to determine the impact of practical teaching on students' attitude towards lessons in biology and their learning achievement. The results of the study were presented in chapter four. This chapter presents the discussions and implications of the results.

5.1 Discussion of the results

Whether practical activities or laboratory teaching affect the students' attitude towards lessons in biology was one of the questions this study has tried to answer. For this purpose, a questionnaire designed and administered on a sample of 59 students. Attitude towards lessons in biology was measured using such items as interest in biology; future career in biology; importance of biology; possibility of becoming a biology teacher; level of difficulty in learning and use of equipment. The questionnaire was designed in such a way that each of these items are measured using a set of questions.

As can be clearly seen form the presentation of the results in table 2 in chapter four, there is an improvement in all measures of attitude both in number and percentage terms after the experiment. There is an improvement in interest of students towards learning because of the intervention. For example, the liking of biology has increased from 36% before intervention to about 87% liking after intervention. Another indicator of improvement in attitude is the students are found to be interested in taking frequent lessons in biology. Moreover, the students have found that using living organisms in their lessons as interesting as evident from an improvement from pretest percentage of 86 to 92% after-treatment. The students' interest in picking up biology as their future career has also shown improvement. Some 97% of the sampled students have shown interest in taking up biology as their career option. After the

treatment, biology is found important in helping to understand other subjects for 93% of the respondents; improve the conceptual skills for 92% and improves the quality of life of another 93% of the students. In addition, there has been an improvement in the liking of biology teachers with the experiment and increasing number of students' perceived their biology teachers as role models. Practical activities has helped about 83% of the students to consider biology as easy subject. This is probably because practical activities have made students to understand the lessons.

The above findings show that the use of practical activities (laboratory teaching) helps to improve the students' attitude towards biology. It helps improve their interest, understanding, motivation and ultimately their achievement. This result is consistent with the findings of (Owino, 2015); Tolessa (2016); (Ozlem,2011); (Kayani , 2017); (Lizabeth, 2012). Exposure to practical work improves students' perceptions of their learning efficiency and the importance of the subject and also enhances the students' achievement and their understanding lesson in biology. For example, (Ozlem ,2011) and (Lizabeth , 2012) found that practical work (laboratory) teaching, if planned properly, and if they are effectively integrated into the learning of concepts, have potential to play an important role in students developing a deep and rich understanding of biological concepts. Laboratory sessions were found to promote thinking skills and to enable students to think more creatively. Moreover, students' attitudes toward science subjects; how students learn science best, what students like about science, and how their understanding of science is found to be directly affected by labs and experiments(Kayani , 2017). (Lizabeth , 2012) found that the liking of students improved from 56% before treatment to 77% after treatment and 88% of the students said that what they liked best about science was the labs. (Tolessa , 2016) in his study in Afar region also found out that lack of interest in science subjects is because of lack of practical activities in teaching them.

Importantly, the students' attitude towards biology was grossly measured pre and post experiment as presented in table 1 in chapter four. The descriptive statistics table clearly shows the improvement in attitude towards biology lessons measured both using average and standard deviation. The average score of pertest attitude is 11.39 where as it is 15.05 after treatment. The standard deviation before and after treatment are 2.06 and 3.14 respectively. It is, therefore, possible to conclude that there is an improvement in the attitude of students towards lessons in biology. The variation in the scores of students is relatively small as measured by standard deviation. However, the extent of improvement is not that great

Off course, practical teaching was found to be most preferred by students even before intervention compared to conventional teaching. About 83% of the students preferred practical work as their learning strategy. This may be due to the fact that practical work is not often used in teaching lessons for various reasons and the students wanted to have more of it. Obviously, things that are rare or not easily found are the most sought out. For this reason students might preferred to have more of practical teaching. Moreover, Practical work develops learners' understanding of ideas, theories and models stimulates creativity, curiosity and critical thinking (Millar , 2004). Absence of any practical activity in science subjects due to laboratory facilities have influence on students score in science and their future study (Seid, 2016). In addition to this implementation of instructional congruence in teaching science has the significant effect in improving students' interest towards science, especially in the aspects of practical work of science (Ahmad, 2010). Laboratory activities in science fields are paramount relevant to make science learning more practical and observable to internalize the theoretical knowledge about natural processes and phenomena. But what the experiment does was it made it more popular. About 92% of the respondents preferred practical teaching over conventional teaching strategy. Hence, practical teaching strategy is popular among the students with or without intervention. Moreover, most students believe

that practical work affects their learning positively. The proportion of students who think that practical work would positively impact learning has increased from 85% before treatment to 93% after intervention.

Another issue of interest to this study was students' achievement. It is possible to speculate that if students have interest in a subject, they are likely to exert more effort in to it and ultimately achieve better results. This research tried to assess the students' achievements both in the descriptive analysis and using correlation study. The analysis revealed that a significant difference exists in achievement of students pre and post intervention. The students achievement has improved after the treatment. The average score of students has increased from 4.10 pre-treatment to 6.74 after treatment. Moreover, the variation in achievement of students is relatively small measured by both range and standard deviation. Accordingly, the minimum and maximum achievement score are 0 and 7 pre-intervention and 4 and 10 after-treatment. The standard deviation of achievement has decreased from a pretest value of 1.61 to 1.39 after-treatment. The possible generalization from this is the intervention has resulted in to improvement in the achievement of students.

Previous research has reached similar conclusions. Practical work has a significantly positive effect on learners' performance (Israel, 2014).Teaching science without practical activities have effect on student's interest towards science disciplines which result in less student enrolments in science class. (Ozlem , 2011) established that hands on activity, as opposed to traditional instruction, enriched students' achievement and attitude towards. (Lizabeth , 2012) reported that their experimental group's achievements were statistically significantly better than those of the control groups in understanding environment concepts. Moreover, a statistically significant improvement was found in the achievements and efficiency of those students who were take the lesson osmosis and diffusion practically. We can explain that by

the fact that practical teaching can make the lesson livelier and make teaching and learning of science more enjoyable and interesting, leading to better understanding. Therefore, we suggest extending this strategy to other subjects in biology as well as to other science disciplines.

5.2 Implications of the results

The findings of this study suggest that practical teaching not only positively affects the attitude of students but also found to be the most preferred learning strategy. Practical work, group work or manual activity sessions are found to be useful as follow-up activities after the practical work sessions. Even without manual activity sessions the practical work lessons are superior to regular lessons. Thus, we can conclude that practical work are useful for facilitating and developing learning, since they promote student interest in the lessons and provide teachers with a greater variety of pedagogical tools. Moreover, practical teaching is found to affect the achievement of students. The increased interest is often translated in to effore and effort leading to better achievement.

There are many implications of these findings. The implications are presented below.

- Practical instructional method has the significant effect in improving students' attitude towards science. Science teaching cannot be effective without students being interested in it. Thus, more practical secession are needed if science teaching has to be effective. Moreover, the way practical teaching is planned and conducted has to be well thought out so that it will boost the students' attitude.
- The amount of practical work increases the quality of science subjects, students' view of science and their achievement. If secondary schools have to lay down the foundation for future scientist, doctors, engineers, teachers etc., practical secessions has to be conducted as effectively and efficiently as possible.
- Producing required number and kind of manpower for the country's development especially in science heavily depends on the way we teach it in secondary schools. It

is at this stage that students will develop their interest in science so that they will pursue it as a career later in their life.

- The consequence of ignoring practical teaching is wide and far reaching. With such a little attention to practical teaching and laboratory work, it will be difficult to achieve progress in science and be competitive. This is because laboratory activities in science fields are paramount relevant to make science learning more practical and observable to internalize the theoretical knowledge about natural processes and phenomena
- Secondary schools, therefore, must work hard to use more practical activities in teaching science disciplines. Laboratory facilities should fully equipped and furnished; all necessary inputs should be made available; training should be given both to teachers and students; laboratory classes should be scheduled and properly conducted. For which the school administration, the concerned government bodies and NGOs must work together to ensure these facilities are available.

CHAPTER SIX

SUMMARY, CONCLUSION AND FUTURE DIRECTIONS

This chapter presents summary of findings, conclusions and future directions. First the summary of indings will be presented followed by conclusions and finally future directions would be suggeted.

6.1. Summary of the study

It would be understatement to say that practical work has a pivotal role in science learning. Specifically, practical work has a key role in teaching science subjects such as biology in secondary school. Teaching science naturally involves showing learners things, or putting them into situations where they can see them for themselves. However, practical work need to be fully integrated as a major element of effective pedagogy in science in order to improve learning in science.

Practical teaching is carried out in most secondary schools with whatever facility, input and manpower that is available. However, to what extent such activities affect the attitude of students towards biology lessons and their achievement largely remains an open question. This particular study attempted to assess the impact of practical work on students' attitude towards biology lessons and their achievement in diaspora secondary school. It specifically tried to answer how practical work that affect learners attitude towards the study of biology; how to improve the implementation of practical work in laboratories; and how learners attitude enhance their achievement.

This study is conducted by taking a random sample of 59 students from 482 of the total grade 9^{th} students in diaspora secondary school. The intervention was an experimental teaching method for two weeks for all participants by randomly selecting topic osmosis and diffusion

from the text. A questionnaire was designed to collect data about attitude of students before and after the treatment. Two tests were designed and conducted to measure students' achievement. The first test was applied before and the second test was applied after the intervention and general six interview questions was used to asses the students view of the teaching learning process in diasspora seconder school

6.2 Conclusions

Based on the data analysis and discussion, the following conclusions are drawn.

- Practical activities or laboratory teaching is found to positively affect the learners' attitude towards lessons in biology. More and effective practical work has led to a more positive attitude. Particularly it was found to enhance the students' interest in biology; future career in biology; importance of biology; possibility of becoming a biology teacher; level of difficulty in learning and use of equipment.

- Practical teaching is found to be the most popular learning strategy compared to conventional teaching. Most students are found to prefer practical teaching more meaningful than the conventional one.

- The ways practical activities are conducted directly affect the attitude of students. Well thought out and planned; effectively executed laboratory education with all the relevant equipment and inputs affects students' learning in varying levels and help the students to be engaged in their learning both mentally and physically.

- A significant positive relationship was discovered between learners' attitude and their achievement. The results of this study clearly show that students having a more positive attitude towards their lesson are found to be better achievers.

- The findings show that the use of effective practical activities (laboratory teaching) helps to improve the students' attitude towards biology. It helped improve their interest, understanding, motivation and ultimately their achievement.

Thus, based on the findings of the study, the reseacher would like to suggest the following future courses of action.

- The way teachers train should be changed, should be make it active in teachers college.
- More attention and consideration should be given to practical teaching in secondary schools.
- There is an urgent need to re-think and re-focus current state of practical teaching in a way that enables effective teaching
- Practical activities should be well planned, effectively conducted and made an integral part of the pedagogy.
- Additional resources for fully furnishing the laboratories; buying inputs; training should be made available.
- The school administration, teachers, relevant government bodies, NGOs, the community should work closely to make sure practical work is conducted effectively.

6.3 Future directions

The current study provided evidence that, if planned properly, practical work can serve as an effective platform for enhancing students' attitude, understanding and achievement of certain biology concepts as well as increase their motivation and interest to learn biology.

In addition, this study focused on the topics of osmosis and diffusion; more key concepts should be researched in order to obtain a more comprehensive picture regarding the

implementation of educationally effective practical activities. A single study can not provide the complete answer to how effectively we can teach science subjects like biology.

We operate in an era in which many attempts are made to develop pedagogical interventions with the goal in mind of enhancing students' interests in attitudes towards learning science in general, and biology in particular. In the current paper we attempted to enhance high school students' conceptual understanding of the concept "osmosis and diffusion", attitude of students towards biology and achivement. It is recommended to develop additional similar practical activites to support the learning of other key concepts taught in middle and high-school biology lessons.

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Appendices

Appendix A

No	Attitude questions	Total participants			Level of agrement													
		M	F	T	Pre-test						Post-test							
					Strongly disagree(dis agree)		Undeside		Strongly agree(agree)		Total		Strongly disagree(dis agree		undeside		Strongly agree(agree)		Total	
		36	23	59	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
1	I like biology more than other subjects				23	39			36	61			8	13.4			51	86.4	59	100
2	Nature and biology strange for me				56	94.9			3	5.1			56	94.9			3	5.1		
3	I would like to have biology lesson more				43	72.8			16	27.1			51	85.4			8	13.6		

	often										
4	**Using living organisms in biology lesson is very interstin g**	**5**	**8.5**	**3**	**5.1**	**51**	**86.4**	**5**	**8.5**	**54**	**91.6**
6	**Biology knowled ge is necessar y for my future**	**2**	**3.4**	**2**	**3.4**	**55**	**93.2**	**2**	**3.4**	**57**	**96.6**
7	**My biology teacher is my personal model**	**48**	**81**	**2**	**3.4**	**9**	**15.3**	**40**	**67.8**	**19**	**32.2**
8	**My future is indeepe ndent from biologic**	**55**	**93.2**	**2**	**3.4**	**2**	**3.4**	**57**	**96.6**	**2**	**3.4**

	al knowledge												
9	I would like to be a biologist	46	78	3	5.1	10	16.9	42	71.2	3	5.1	14	23.7
10	Biology helps to develope my conceptual skill	4	6.8	5	8.5	50	84.7	2	3.4	3	5.1	54	91.5
11	Biology is not important in comparison with other courses	54	91.5			5	8.5		91.5			5	8.5
12	Biology is essential for understanding other courses and	4	6.8	2	3.4	53	89.8	54	6.8			55	93.2

	phenomena												
13	Nobody needs biology knowledge	54	91.5	2	3.4	3	5.1	54	91.3	2	3.4	3	5.1
14	The progres of biology improvesthe quality of our lives	8	13.6			51	86.4	4	6.8			55	93.2
15	I like our biology teacher	28	47.5			31	52.5	22	37.3			37	62.7
16	Our biology teacher makes us do active work	53	89.8			6	10.2	27	45.8			32	54.2

17	I have often difficulties to understand what we have learn	22	37.3			37	62.7	27	45.8			32	54.2
18	Biology is one of easiest courses for me	15	25.4	1	1.7	43	72.9	10	16.9			49	83.1
19	Our biology teachers use drowings and pictures	51	86.4	3	5.1	5	8.5	43	72.9	1	1.7	15	25.4
20	We never use any biology equipment	35	59.3			24	40.7	23	39.0			36	61.0

Appendix B

B/DR UNIVERSITY

COLLEGE OF EDUCATION AND BEHAVIORAL SCIENCE

DEPARTMENT OF TEACHING SCIENCE

RESEARCH QUESTINEAIR FOR GRADE 9th STUDENTS OF DIASPORA SECONDERY SCHOOL.

First of all I would like to say thank for your honest participation of the study**.**

The **main objective** of this research questionnaire is to assess students' attitude towards biology lessones for enhancing their achivement. This will be done by implmenting more practical activity during teaching learning activities.

Attitude pre- post-test

I. Circle your answer for the following questions as the direction of the questions listed bellow

1. Your age range?
   A.12-14 B. 15-17 C. 18-21 D. 22 and above
2. Sex. A. Female B. Male
3. Where are you learn your junior school?
   A. Gedro B. Zenzelima C. Tsihay gebat D. Others
4. Do you take biology courses before?
   A. Yes B. No
5. If your answer is yes, how do you see the teaching learning process you took before?
   A. More practical B. Some times practical C. Full of lecture
6. Dose your biology teacher of grade 9th use practical activies to teach biology lessons?
   A. Allways B. Some times C. Never

II. There are five-points Likert scale; ranging from “strongly disagree” to “strongly agree” for each questions and select the one that your best chooise and mark X()

No	Catagoriy	Strongly disagree	Disagree	Undeside	Agree	Strongly agree
2.1	**Interest toward biology**					
2.1.1	I like biology more than other subjects because of its practical activites					
2.1.2	Nature and biology is strange for me					
2.1.3	I would like to have biology lessons more often					
2.1.4	I hate biology lessons when i took it by lecture					
2.1.5	The work with living organisms in biology lessons is very interesting					
2.2.6	I like watching natural history films; I would like therefore make a career in this in this field					
2.2	**Future career in biology**					
2.2.1	Biology knowledge is necessary for my future career					

2.2.2	My biology teacher is my personal model, I would like to work like he					
2.2.3	My future career is independent from biology knowledge					
2.2.4	I would like to be a biologist					
2.3	**Importance of biology**					
2.3.1	Biology helps development of my conceptual skills and motivet me tobe a feature scientist					
2.3.2	Biology is not important in comparison with other courses					
2.3.3	Biology knowledge is essential for understanding other courses and phenomenon					
2.3.4	Nobody needs biology knowledge					
2.3.5	The progress of biology improves the quality of our lives					
2.4	**Biology teacher**					
2.4.1	I like my biology teacher					
2.4.2	Our biology teacher makes us do					

	active work					
2.4.3	Our biology teacher disregard aspiration of students with bad rating					
2.5	**Difficulty**					
2.5.1	I have often difficulties to understand what we have learn in biology					
2.5.2	Biology is one of the easiest courses for me					
2.5.3	I like the way how biology is teaching in our school					
2.6	**Equipment**					
2.6.1	Our biology teacher makes drawings or uses pictures in each practical works					
2.6.2	We never use any biology equipment					
2.6.3	When I prepare for biology lesson, I bring to mind equipment that we have used in biology					

III. Write your opinion for the following questions

1. What type of teaching strategy you prefer for your biology learning?

---.

2. Do you belive that the teaching strategy you select positivelly affect your interest on biology? why

---

---.

3. Do you belive that the teaching strategy you select affect your achivement? why

---

---.

4. How learning biology practically change your interst and achivement?

---.

5. What do you like possibly stak hollders do for better biology teaching?

Appendix C

Intervew questions for participant students

1. How practical teaching affected yourr understanding and your satisfaction of learning substance transportation (osmosis and diffusion) topics?
2. What method of teaching you will implement if you choose to be a biology teacher in the future
3. How this method affected teaching the application of biology in everyday life
4. How and to what extent has this method influenced your interest in the biology - What is your feeling?
5. Do you belive that practical teaching change your perception on biology how?
6. Do you belive that practical teaching has affected your motivation to continue studying biology in the future? To what extent?

Appendix D

Biology pre- post- achivement test on osmosis and diffusion for 9 thE students

❖ Choose the correct answer from the given alternatives

1. The movement of water from hihg potential to law potential of water is ----------?

A. Diffusion B. Ion transport C. Osmosis D. none

2. ----------is means of gas molecules to spread , to flow out, to extend to all direction?

A. Diffusion B. Ion transport C. Osmosis D. none

3. What will happen when animal cell placed in hypotonic surrounding?
   A. Burist B. Plasmolysis C. H_2O move out of the cell D. none

4. ---------- is the condition there is no net movement of water?

   A. Hypertonic cell in hypotonic surrounding B. Isotonic condition C. Hypotonic cell in hypertonic condition D. All

5. Which factors affect rate of diffusion?

   A. Membran thikness B. Concentration difference C. Temprature D. All

❖ Write short answer for the following questions

6. What will happen in plant cell when the cell placed in

A. Hypertonic solution

B. Hypotonic solution

C. Isotonic condition

7. What will happen when animal cell placed in

A. Hypertonic solution

B. Isotonic condition

8. write the importance of water movement for cells of an organism

---

Appendix E

Lecture Note

Substance transportation

Diffution and osmosis are different ways by which materials are transported into and out of the cell across the cell membrane.

Diffusion

Diffusion: - to sprid, to flow out, to extend to all direction,to disperse. The movement of particles of mater dueto their own kinetic energy.

- particles move from high concentration to the lower.
- Diffusion is takes place until concentration is equalin the two region.
- The rate of diffusion is determined by factors such as:- density ,of substance diffsing and medium in which they move ,tempratureand concentration difference(gradient).

Diffusion occurs in a presence of consentration (chemical potential) gradient and it results in net transport of mass.

osmosis

osmosis is special type of diffusion through semi permable mambrance . water molecules diffuses through the membran in to the stronger solution in an effort to equalize the concentration of the tow solutions.

In osmosis , solvent (water) molecules are moving, but not solute(salt) molecules.

Osmoic coonditionns

A cell may face three types of osmotic conditions.

1. Isotonic condition

Concentration of solute inside and out side the cell is equal. There is no movement of particles and no change in the cell.

2. Hypertonic cell and hypotonic surrounding

Concentration of solute inside the cell is greater than the out side.the cell is said to be hypertonic to the surrounding or the surrounding is hypotonic to the cell. Water moves into the cell from the surrounding, in order to equalize the concentration by diluting the inside of the cell.

Result of water entering to the cell:

- The cell increase in size, turgidity of the cell.
- The pressure developed is called turgor pressure.
- As more water enters, the cell membrane start to counter act turgor pressure.the pressure developed by the cell membrane and cell wall of plant cells is called wall pressure.
- If turgor pressure exceeds wall pressure, the cell will burst and dies. Plant cells resist turgidity more than animal cells due to their rigid cell wall.

3. Hypotonic cell and hypertonic surrounding

The solute concentration is lower inside the cell than the outside. Water move from the cell to the surrounding.

Result of water moving out of the cell

- The size of the cell decreases or the cell shrinks.
- The cell is said to be limp or flaccid. In plant cells this shrinkage of cells is called plasmolysis, and the cell is said to be plasmolysed. In animal cells the process is termed as crination.
- The wilting of plants is an example of plasmolysis.
- The point where the cell just starts plasmolysis is called incipant plasmolysis.

Appendix F

LESSON PLAN

SCHOOL NAME :- DIASPORA GENERAL PREPARATORY AND SECONDERY SCHOOL

NAME OF TEACHER:- CHEKULA SITOTAW

SUBJECT:- BIOLOGY

CLASS & SECTION:- 9^{th} E

NUMBER OF STUDENTS :- M = 36 F= 23 T= 59

TOPIC:- SUBSTANCE TRANSPORTATION IN PLANT CELL.

SUB TOPIC:- OSMOSIS AND DIFFUSION

DATE:- 11-22/06/2011 EC

Holl task befor one week of the lesson start

Assume that one day you go to dallol in afar region . Dallol is avery hotesst area in ethiopia and it is one of turist attraction are in afar region. One day you go to dallol with your firends for recration porpuse . you have no water to drink but you need to drink water, And You creat an idea to by water in the shope but you go far from the shope, One of your firend says why not we dirrive the car and start to dirive . after two minits your car stop saddenlly because of it finish the fuil . there is no gas station to fill the car. You and your frinds live in the car for three days without water .

- What will happen on you and your frends because of shortage of water?
- Do you belive that ashortage of water affect your life? How?
- How sabstance and west transported with out methabolic energy in your body?

GENERAL OBJECTIVE :-At the end of this lesson students will be able to understand the way of substance transportation. (diffusion and osmosis) and its effect on cell structure.

SPECIFIC OBJECTIVES :- at the end of this lesson students will be able to

-Describe the word osmosis and diffusion

-Relates the direction of water movement in plant cell with animal cell atherparticles like

gas.

-Conduct an experment and observe changes occured during the movement of water in plant cell.

Time	Teaching learning activeties	Students activity	Teachers activity	Evaluation
5`	Ìntroduction	Try to discous on the holl task	Motivete learners to participate and involve in discution	The holl task
10`	Discutiono n	Answer the questions by remembering ,recall their prerequisit knowledge. Sher their experianc in agroup of three	Ask questions for students that help students to rememember their pri conception. For assesing learners pre conception. Introduce the lesson detail . Motivate learners to sher their experiance for the class.	What do you know about diffusion? What do you know about osmosis? What is the role of water in plant life? Who one describe brifely the word osmosis? Who sher experianse you have on osmosis in plant cell?
20′	Presemtati on	Do some simple experments in the class(osmosis) and answer the question posed by the teacher	When they perform an experment on osmosis in plant and pose question Write the note on the	What problems do you get from the experment? How you solve the problem? W hat you understand

		Note taking and Leesen carfully the presentation and pose question	black bord fasilitate learners. Explain detail about the lesson.	from the experment you did? What change occure on potato tuber?
7′	Summeriz atiom	Summerize the lesson by thair own language	ask students to summerize the lesson by thair own language	What do you understand from to days lesson? How do you evaluate (do you belive you achive the objective of the lesson)?
Tec hing aid	Potato , sugar(salt), water, beaker, naifves, food colours, boiller, sprie and borer			

v.director sign---------- dept head sign---------- teachers sign----------

Appendix G

How does osmosis affect potato tissue?

There are two alternative ways of carrying out this same experiment. Potato is the most common vegetable chosen but you could use others such as sweet potato or yam and compare the results you obtain. The basic equipment is the same for both methods. You will need:
• a potato

a cork borer or apple corer and a sharp knife or scalpel

a tile or chopping board
• three test tubes or beakers
• tweezers
• a balance if possible (sensitive to 0.1 g)
• a ruler
• filter paper
• 1M sucrose solution
• marker pen

Method

1. If you have a cork borer or apple corer, cut three cylinders out of your potato. Trim the skin off the top and bottom and cut them all to approximately the same length. If not, cut three long blocks from your potato (approximately 5 cm x 1 cm x 1 cm) and trim off any skin from the top and bottom.

2. Half fill one boiling tube with tap water and label it. Half fill another with 1M sucrose solution and label it. Leave the third tube empty.

3. You are going to be measuring changes in your potato cylinders, so make sure that you know exactly which cylinder you are going to place in which boiling tube before you start measuring! You can draw out tables to record your observations.

4. Measure the length of each cylinder as accurately as you can and record the measurement.
5. Gently blot each potato cylinder with filter paper to remove excess moisture. If you have a balance available, find and record each mass carefully.

6. Place one cylinder in your tube of water, one in 1M sucrose solution and one in the air. Leave them for a minimum of 30 minutes.

7. Using the tweezers, remove each cylinder of potato and blot it dry if necessary.