ETHIOPIAN JOURNAL OF EDUCATION STUDIES

Volume 1(2), 2023



HAWASSA UNIVERSITY

"EDUCATION IS THE MOST POWERFUL WEAPON WHICH YOU CAN USE TO CHANGE THE WORLD."
NELSON MANDELA

Table of Contents

	Title	Author	Page
1	Misconceptions as a barrier to understanding biological science lessons: A systematic review of pertinent studies	Girma Moti Geletu, Yidnekachew Awraris, Firew Kebede & Samuel Assefa	1-21
2	Dynamic factors affecting undergraduate health science students' learning engagement, academic engagement, academic performance and achievement at Hawassa University, Ethiopia	Girma Moti Geletu, Mekdes Mekonnen Belay and Bachu Taye Welteji	15-33
3	The role of self-leadership strategies in coping with stress level of freshmen students entered in 2020 at Hawassa University	Gelan Gagura, Woma Gabiso and Abenet Wondimu	34-52
4	Contributions of laboratory practical works to quality of science teaching-learning process and student learning engagement in Hawassa City Administration	Sisay Girma Sereto and Girma Moti	53-67
5	Perception and performance of secondary school science teachers' inquiry-based methods of teaching in Hawassa University Technology Transfer Villages	Girma Moti Geletu, Janbo Guduru Figa & Seboka Geleta Tonkolu	68-81

Editorial team members

S.No.	Full name	Position	e-mail	Phone number
1.	Girma Moti, PhD	Editor in chief	girmamg@hu.edu.et;girmam2015@gmail	+251927277109
2.	Solomon Wolde, PhD	Editorial Manager	solomon.wolde@hu.edu.et	+251912013910
3.	W/ro Bachu Taye, M.Sc	Copyeditor	bachutaye@hu.ecu.et	+251945217731
4.	Geda Hoka Momecho, MA	Layout Designer	gedahoka@hu.edu.et	+251911264610
Associate (Section) Editors				
5.	Demekash Asregid, PhD	Associate (Section) Editors	demekash@yahoo.com	+251913289258
6.	Kefyalew Gelalcha, PhD	Associate (Section) Editors	kiyyuma@gmail.com	+251911750706
7.	Eshetu Mandefro, PhD	Associate (Section) Editors	eshe1974@gmail.com	+251925534032
8.	Tesfaye Basha, PhD	Associate (Section) Editors	tesfayeask@yahoo.com	+251910850736
9.	Wondimagegn Girma, PhD	Associate (Section) Editors	wondimagegn.girma@gmail.com	+251926046375
Advisory Board Members				
10.	Tesfaye Semela, Professor	Editorial Advisory Board Member	tesfayes@hu.edu.et	+251916824225
11.	Yalew Endaweke, Professor	Editorial Advisory Board Member	yalew_em@gmail.com	+251913402108
12.	Anders Breidlid, Professor	Editorial Advisory Board Member	Anders.Breidlid@hioa.no	+472245160/90952648
13.	Dessu Wirtu, PhD	Editorial Advisory Board Member	dessu.wirtu@gmail.com	+251912041575
14.	Samuel Assefa, PhD	Editorial Advisory Board Member	samueassefa@hu.edu.et	+251916578899
15.	Daniel Desta, PhD	Editorial Advisory Board Member	danield@gmail.com	+251913205737
16.	Abraham Tulu, PhD	Editorial Advisory Board Member	abraham.tulu@aau.edu.et	+251911111819
17.	Anteneh Wasyihun, PhD	Editorial Advisory Board Member	antenhewasyhun@gmail.com	+251927151508
18.	Dereje Demissie, PhD	Editorial Advisory Board Member	demissiedereje75@gmail.com	+251911119443
19.	Dawit Legese, PhD	Editorial Advisory Board Member	dawitlegesse@hu.edu.et	+251911922145
20.	Habtemariam Kassa, PhD	Editorial Advisory Board Member	habtekassa@gmail.com	+251911079478
21.	Anteneh Tadesse, PhD	Editorial Advisory Board Member	antenehtd@yahoo.com	+251912644842
22.	Halldis Breidlid, Professor	Editorial Advisory Board Member		+472245160
23.	Per Olof Hansson, Professor	Editorial Advisory Board Member		+46(0)13 28 20 20

Ethiopian Journal of Education Studies
OPEN ACCESS
ISSN(online): 27892875
Web link: https://journals.hu.edu.et/hu-journals/index.php/eies/

Original Article

Misconceptions as a barrier to understanding biological science lessons: A systematic review of pertinent studies

Girma Moti Geletu [1*], Yidnekachew Awarris [2], Firew Kebede [3] & Samuel Assefa [4]

[1,2,3,4] Department of Biology and School of Teacher Education, Hawassa University

ARTICLE INFO

Volume I, Issue II (2023)
https://doi.org/10.20372/yydvmm03

CORRESPONDING EMAIL
* Corresponding author email: girmam2015@gmail.com

ARTICLE HISTORY
Submitted: 26 Jan, 2023
Accepted: 08 Jun, 2023
Published Online: 31 Jul, 2023

CITATION
Geletu, G.M., Awarris, Y., Kebede, F. and Assefa, S. (2023). Misconceptions as a barrier to understanding biological science lessons: A systematic review of pertinent studies. *Ethiopian Journal of Education Studies*. Volume I, Issue II (2023), 1-21. https://doi.org/10.20372/yydvmm03.

OPEN ACCESS
This work is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

KEYWORDS:
biological science; misconception as barriers; learning concepts

Abstract

This systematic review explored the pervasive issue of misconceptions hindering understanding in biological science lessons, focusing on factors contributing to these misconceptions and ways to rectify them. The study employed a qualitative content analysis. Students often harbor misconceptions rooted in everyday experiences, language nuances, teacher methodologies, and textbooks. Biology, known for its complexity, abstract nature, and scientific terminology, poses particular challenges. Several studies conducted both abroad and in Ethiopia highlight high levels of misconceptions among students, particularly in topics such as cell biology, genetics, photosynthesis, and human anatomy. Existing research suggests that traditional teaching methods contribute to misconceptions, emphasizing the need for a constructivist approach, concept maps, clinical interviews, and inquiry-based learning. Ultimately, understanding and addressing misconceptions have implications vital for fostering meaningful learning experiences in biology education.

1 Introduction

Human beings can acquire knowledge and explore the vast horizons of the universe through logic and observation, a process that evolves into scientific knowledge (Tekkaya, 2002). Students bring diverse pre-existing ideas and explanations about the natural world to school. Misconceptions, defined as mental representations deviating from currently accepted scientific theories, can be categorized into alternative or experiential or intuitive or native conceptions and instructional misconceptions (Kesidou and Duit, 1993; Skelly and Hall, 1993; Nakiboglu, 2003). These misconceptions significantly impact students' learning, hindering their understanding of advanced concepts. Failure to address initial misconceptions may result in a lack of comprehension of new information or a surface-level understanding solely for test purposes, reverting to misconceptions outside the classroom (Özmen, 2004).

Children's misconceptions in science after formal education can be traced to three main sources: informal ideas derived from everyday experiences, incomplete or improper views

developed during classroom instruction, and erroneous concepts propagated by teachers and textbooks (Yip, 1998). It is widely acknowledged that students enter biology classes in Ethiopia with one or more of these misconceptions. Despite limited efforts to identify misconceptions in physical and life sciences like biology, physics, chemistry, and mathematics in Ethiopia (Engida, 2002). Thus, this review aims to offer an overview of misconceptions in biological science by exploring literature from both international and local sources.

1.1 Objectives

In this context, the review paper assesses the definitions of misconceptions, explores factors contributing to students' misconceptions, delves into common misconceptions in biology, discusses methods to correct misconceptions, and examines previous research on misconceptions, aiming to identify any existing research gaps. Therefore the study helps:

1. To identify sources of biology misconceptions that hinder students' learning.
2. To explore strategies of minimizing levels of misconceptions' in biology learning

2 Definitions of misconception

Misconception is defined by various authors in various ways. A misconception can be identified as something that people believe, but that are not actually correct. In broad terms, misconceptions correspond to the ideas that have personal perceptions and meanings in students' articulations that are defective (Bahar, 2003). In the literature, misconceptions are also indicated to as "alternative conception" (Dikmenli et al., 2009; Kurt, 2013; **kurt2013biology2**; Cinici, 2013), "misunderstanding" (Kılıç and Sağlam, 2009; Kirbaslar et al., 2009).

3 Factors Contributing to Students' Misconceptions

Misconceptions are developed by students from various resources. Misconceptions contrast with scientific concepts, and the most common factors as reported by different authors includes: influence from everyday life experiences (Abraham et al., 1992; Smith III et al., 1994; Kaltakci and Eryilmaz, 2010; Suniati et al., 2013; Widarti et al., 2016), teachers (Kaltakci and Eryilmaz, 2010; Gudyanga and Madambi, 2014; Satilmis, 2014; Erman, 2017), reference book or textbook (Devetak et al., 2007; Kaltakci and Eryilmaz, 2010; Gudyanga and Madambi, 2014; Widarti et al., 2016; Erman, 2017) and confusion of everyday language used as factors contribute to misconceptions (Osborne et al., 1983; Abraham et al., 1992; Tyson et al., 1999; Bahar, 2003; Boz, 2006; Suniati et al., 2013; Erman, 2017).

3.1 Everyday experiences

Students' interactions with the environment in their daily life experiences can lead to confusion (Smith III et al., 1994; Agnes et al., 2015). As students become acquainted with their surroundings and spend significant time outside of school, they develop personal explanations for the meanings of things in the world around them. These explanations

often diverge from scientific meanings. The understanding of science concepts by students is primarily influenced by their interactions with the surrounding environment and is intertwined with their daily life experiences (**arif2018**).

3.2 Language used

Students encounter challenges when scientific terminology is incorporated into everyday language. The use of scientific words in ordinary communication may contribute to students developing misconceptions (Osborne et al., 1983; Boz, 2006). The discrepancy between the technical language of science and its colloquial usage can create confusion and hinder students' accurate understanding of scientific concepts. Additionally, the potential for misconceptions arises when scientific terms are employed in a context that differs from their precise scientific meaning, adding a layer of complexity to students' comprehension. Therefore, bridging the gap between scientific language and everyday communication is crucial to minimizing misconceptions and promoting clearer understanding among students.

3.3 Teachers

Teachers propagate misconceptions because of their inability to communicate effectively with students (Gudyanga and Madambi, 2014). In some cases, teachers may be unaware of student's difficulties and fail to take appropriate methods in presenting specific ideas to students (Kaltakci and Eryilmaz, 2010). Furthermore, Satilmis (2014) stated that students had misconceptions due to ineffective teaching method especially when the teachers followed the traditional method. A teacher fails to present abstract concepts appropriately, either by visualization or analogy to help students understand the concepts (Treagust et al., 2003).

Teachers' misconceptions themselves can be a source of students' misconceptions (Gudyanga and Madambi, 2014). This suggests that there is a possibility of teachers transferring their misconceptions to students, given that they serve as the primary source of instruction. When teachers learn abstract concepts during their training without a clear understanding, they run the risk of disseminating these misconceptions to their students. Therefore, it is crucial for science teachers to possess a clear conceptual understanding of scientific concepts in each learning activity to avoid perpetuating misconceptions in the classroom.

3.4 Textbook

Textbooks, as tools employed in the teaching-learning process and as guides for both teachers and students, play a crucial role in the construction of conceptual understanding. However, they can also contribute to the occurrence of misconceptions (Devetak et al., 2007; Gudyanga and Madambi, 2014). The presence of unclear figures in textbooks is identified as one factor leading to misconceptions, particularly at the submicroscopic level (Devetak et al., 2007). Additionally, textbooks may not consistently offer complete or accurate information and explanations (Gudyanga and Madambi, 2014). Furthermore, the presentation of information in symbols within textbooks can pose challenges for student comprehension (Gabel, 1998; Widyatmoko and Shimizu, 2018). Addressing these issues in textbook design and content is essential to ensure that they effectively contribute to students' accurate understanding of scientific concepts.

4 Commonly observed misconceptions in biology

Many students have misconceptions about what science actually is and how it works. Biology is one of the courses in which students experience difficulty (Keleş and Kefeli, 2010). The content and complexity of biological notions, common ideas, deficiency of biological knowledge and additionally the hidden nature of many key processes cause biology to be an especially hard subject to teach and to learn (Sesli and Kara, 2012). Moreover, its abstract nature and scientific terminologies make biology confusing (Kumandaş, 2015).

During the past two decades, several studies have investigated students' understanding of biological concepts in different countries: Cell (Dreyfus and Jungwirth, 1988), photosynthesis (Bell, 1985, Haslam and Treagust, 1987, Waheed and Lucas, 1992), respiration (Sanders, 1993), genetics (Pashley, 1994, Lewis et al., 2000), ecology (Griffiths and Grant, 1985, Munson, 1994), classification (Trowbridge and Mintzes, 1988), the circulatory system (Yip, 1998), vertebrate and invertebrate (Braund, 1998) and energy (Boyes and Stanisstreet, 1991).

The above studies revealed that students "have misconception about different concepts of biology, and they leave secondary school with a distorted view of concepts, objects and events".

Research has shown that students have difficulty making the connection between molecular and cellular organization (Driver et al., 1994). Students seem to understand that both atoms and cells are made up of smaller parts including the nucleus. However, they struggle to conceptualize the foundational principal that all matter including cells is made of atoms. This misunderstanding seems to perpetuate beyond differentiation between cells and atoms in their understanding of the structure and function of macromolecules. According to the American Association for the Advancement of Science (1994), students should experience a progression of their understanding of cell structure and function as they move through the grade levels. As elementary students they should have an understanding that some parts of organisms must be seen through a magnifying glass and then as they enter the upper elementary grades, they should begin to form the concept of a cell as the basic unit of life. Finally, as they exit middle school students should have a clear understanding of basic cell function. By the end of the 12th grade, students should have knowledge and understanding of the nature and function of proteins and the specialization of organelles within the cells including the cell membrane.

However, Driver et al. (1994) show that students often confuse the concepts of molecules and cells. Often times, students have a very general concept of molecules and cells both of which contain a nucleus and are surrounded by other small things. This confusion seems to stay with children through the teenage years. Also, students at the high school level tend to think that larger macromolecules such as proteins and carbohydrates are made of cells rather than atoms. They did not understand the difference between cells and molecules. More confusion has been found in students' ability to differentiate the sizes of cells and atoms. Many students at the high school level believe that cells and molecules of protein are the same size. Driver et al. (1994) also found that students believe single-celled organisms contain intestines and lungs.

Moreover, a large number of prior studies reported that primary and secondary school students have many conceptual problems concerning cell biology and genetics (Lewis et al., 2000; Marbach-Ad and Stavy, 2000; Flores et al., 2003).

If higher education curriculum designers knew students' misconception, it might be helpful to prepare effective teaching strategies. Teachers can play an important role in teaching scientific concepts and from a constructivist perspective students should gain meaningful knowledge about biological concepts like cell biology and cell division. Biolog-

ically literate students should be able to use and apply basic biological concepts when considering biological problems or issues. Prior studies have shown that students experience difficulties in learning concepts related to the cell division process (Kindfield, 1994). Cell division constitutes the basis for genetics, reproduction, growth, development and molecular biology subjects in the biology curriculum. However, as a matter of fact, a majority of the students evaluated topics such as gene, DNA, chromosome and cell division as difficult to learn topics (Öztap et al., 2003).

Research on students' conceptual understandings on Cell division often indicates that even after being taught students use misconception different from the scientific concepts (Lewis et al., 2000; Yeşilyurt and Kara, 2007). Reasons for this misconception include students' inability to differentiate between doubling or replication, pairing or synapses and separating or disjunction, as well as determining whether or not these processes occur in mitosis, meiosis or both (Smith, 1991). Further misconception includes a lack of understanding of basic terms confusing chromatids with chromosomes or replicated chromosomes with un replicated chromosomes etc. (Kindfield, 1994). This is a concern for instructors because cell division processes are fundamental to the understanding of growth, development, reproduction and genetics (Chinnici et al., 2004; Cordero and Szweczak, 1994).

Studies conducted on problem-solving related to genetics revealed that students have some misconception regarding the stages of meiosis (Brown, 1990, Stewart and Dale, 1989). Accurate organizing of many concepts in cell biology is dependent on the degree of understanding cell division (Smith, 1999). As a matter of fact, a study related to genetics revealed that students possess misconception and inadequate knowledge about the behavior of chromosomes and transference of genetic material during cell division. It further suggested that such misconception led to conceptual problems in genetics (Kibuka-Sebitosi, 2007). Tekkaya and Yenilmez (2006) studied the misconception possessed by 9th grade students relating to cell division and the effect of the conceptual teaching regarding elimination of such conceptions. They hypothesize that conceptual teaching is an effective method for understanding the concepts related to cell division and for elimination of misconception.

Lewis et al. (2000) also studied the students' levels of understanding in regards to mitosis, meiosis and fertilization. The result of their study revealed that students possess inadequate knowledge and numerous misconceptions related to the physical relationships between the genetic material and the chromosomes and the relationships between the behavior of the chromosomes and continuity of the genetic information. Lewis et al. (2000) further emphasized the fact that the students mainly experience difficulties for explaining the relationships between the cell, nucleus, chromosome and gene concepts and the similarities and differences between mitosis and meiosis.

Clark and Mathis (2000) indicated that students experience difficulties particularly for discriminating chromatids, chromosomes and the homologous parts of the chromosomes during the cell division process. Atilboz (2004) studied the level of understanding and misconception of 9th grade students related to mitosis and meiosis. The result of the study showed that students experience difficulties in understanding fundamental concepts such as DNA, chromosome, chromatids, homologous chromosomes, haploid and diploid cells and the relationships between such concepts and possess some misconception.

Lewis et al. (2000) found that students in United Kingdom seemed to have a poor understanding of the processes by which genetic information is transferred and a lack of basic knowledge about other related concepts such as chromosomes, cell division and inheritance.

Saka et al. (2006) state that a science student has misconception particularly regarding

the concepts of gene and chromosome in accordance with their findings obtained from written responses and drawings. Krüger et al. (2006) studied the concepts of students regarding cell division and growth, and the study revealed that students generally focus on the increase occurring with number of the cells, as a result of cell division and disregard the growth occurring in the cells. They also indicated that such difficulties experienced during understanding such concepts might be overcome by learning activities that researchers have developed. Riemeier and Gropengießer (2008) analyzed the difficulties in learning as experienced by the 9th grade students regarding cell division and their conceptual understandings with in teaching experiments. They have shown that well planned teaching activities for the cell biology and cell divisions might enhance the conceptual development process and might contribute to the conceptual learning by the students. It is obvious from the literature that misconception related to cell division processes lead to a series of problems for the biology teaching. When attending their biology classes, students bring their perceptions, prejudices and former experiences in conflict with the scientific facts. This situation causes various problems to arise during their biology classes. Keeping knowledge or conceptual frames of the students in line with the scientific facts can only be possible with effective conceptual teaching.

Recently, several studies have also been conducted regarding biological science misconceptions. Putri et al. (2017) conducted a study on analysis of misconception of university students about biological evolution. The result of their study revealed that misconception found in high percentage. Their result also indicates that biology major students held wrong conceptions about evolution. Halim et al. (2018) conducted a study on Identifying and Remediating Student Misconceptions in Introductory Biology. The result of their study revealed that a greater number of misconceptions were identified pertaining to protein structure and function. They also reported that students used scientific terminology incorrectly. Some of the incorrect uses of terminology by the students include considering "Polypeptide bonds" as the same as "chains," interpreting "Protein unfolding," "misfolding," and "denaturing" as identical, and confusing "Alpha helix" with "double helix." Kapici and Akcay (2016) also reported that misconceptions about the particulate nature of matter are more common in middle school students compared to high school students. Yücel and Özkan (2015) found that most secondary school students had weak cognitive structure about Ecological concepts and they acquired superficial knowledge from their daily life and contained many misconceptions. On the other hand, Butler et al. (2015) also found that high level of misconception was reported in upper secondary school students and pre service teachers towards understanding of Ecological concepts.

Orbanic et al. (2016) also conducted a study on students' misconception about photosynthesis. The result of their study revealed that students who taught through traditional teaching method develop misconception towards photosynthesis as compared to students who taught through constructivist teaching method. Besides, Liu and Li (2013) also found that both the teachers and the students have misconception in photosynthesis and respiration.

AlHarbi et al. (2015) conducted a study on pre service teachers understanding of diffusion, osmosis and particle theory of matter concepts. The result of their study suggests that the pre-service science teachers in general experienced difficulty in understanding the principles of the particle theory of matter. However, they reported that the pre-service teachers' understanding of diffusion and osmosis was satisfactory.

Vitharana (2015) conducted a study on student misconception about plant transport. The analysis of student's responses reveals that students do not have a correct conceptual understanding of mechanisms responsible for plant transport especially osmosis, diffusion, active transport and transpiration.

Stevens et al. (2017) also found that students in higher institutions develop misconception in introductory microbiology courses particularly towards the topic antibiotic resis-

tance and host pathogen interaction concept inventory. Regarding to human anatomy and physiology, Taufiq et al. (2017) conducted a study on identification of pre service biology students' misconception in human anatomy and physiology course. The result of their study showed that majority (61.5%) of the students developed misconceptions in human anatomy and physiology courses. In detail, the finding of the study showed that participants develop misconception in skeletal system (57.81%), muscular system (52.34%), integumentary system (55.47%), nervous system (51.04%), endocrine system (54.69%), hemolymphatic system (66.02%), cardiovascular system (62.89%), respiratory system (68.75%), digestive system (70.31%), urinary system (70.7%) and reproductive system (71.88%). Misconceptions were mostly developed on reproductive system sub materials and less likely found in nervous system sub materials.

Aniyah et al. (2018) also reported that the overall level of grade 8 students' misconception on the transportation system of humans and plants in Indonesia is quite high that is on average about 60%. The location of misconception of each student is different. The highest misconception profiles were the absorption of water occurs diffusion and absorption of minerals occur osmosis (76.7%). Wahyono and Susetyarini (2021) conducted a study on Misconceptions of biology education students in Biochemistry Course during the COVID-19 pandemic. The result of their study revealed that 53% of the students experienced misconception in biochemistry course.

In Ethiopia, there were a few attempts to conduct a study on biological science misconception. Hailegebreil (2014) conducted a study on students' misconception about cell biology and cell division in Kelafo secondary school, Somali region Ethiopia. The result of his study showed that majority of the students had high level of misconception about cell biology and cell division and 16 types of common misconceptions about cell biology and cell division were identified and categorized into: definition of cell biology and cell division, structures and functions, types, energy and cell cycles. Moreover, the observed classes of cell biology and cell division lessons showed that all biology teachers did not implement effective instructional methods to remediate students' misconceptions.

Basha et al. (2014) also conducted a study on misconception of students about photosynthesis and cellular respiration in secondary schools of East Arsi, Ethiopia. The result of their study showed that high levels of misconceptions were observed (in more than 50% of students) in defining photosynthesis and concept of food making by green plants. They also reported that biology teachers' methods of instruction to teach photosynthesis and respiration and techniques used to remediate students' misconceptions were found to be ineffective and were not in line with the methods of teaching depicted in the textbook, syllabus and teacher's guide. Moreover, Dagnew and Mekonnen (2020) conducted a study on effect of using guided inquiry teaching method in improving grade eight students' misconception on the concept of photosynthesis in primary schools of Ethiopia. The result of their study revealed that those students who taught through inquiry-based teaching develop more conceptual understanding on the concept of photosynthesis than those students who taught through traditional teaching methods. Yenenesh et al. (2020) also found that primary school students taught through concept map method develop more conceptual understanding on the concept of photosynthesis than those students who taught through traditional teaching methods. Furthermore, Dagnew and Endris (2020) conducted a study on Model-based instruction to improve the concept of students on human anatomy in primary schools of Ethiopia, and showed that the model-based teaching approach improves students' conceptual understanding, participation and clear misconceptions compared to the students taught by traditional teaching approach.

After the recognition of misconceptions, the next step is correcting them (Allen, 2010). If teachers are to diagnose or become familiar with their students' views, they can apply some strategies accordingly (Çakır, 2008).

As reported by Devetak et al. (2007); Gudyanga and Madambi (2014), textbooks are one of the sources of misconceptions. To overcome this problem, there is a need to provide more concentration towards the curriculum developers and the textbook authors. The content should be arranged in such a manner which provides complete information and give examples which makes easy to understand the content. In addition to this, the content should be managed in such a manner which will help to make connection between new and previously existing concepts.

According to Treagust et al. (2003), teachers are less competent over the biology subject and fail to present abstract concepts appropriately. So, teachers should have adequate subject knowledge before entering into the classroom. The teachers should also have much mastery over the content and similarly should have the quality to simplify the content as per the learners understanding level.

Liu and Li (2013) also found that sound knowledge of the teacher is very necessary to minimize or eliminate misconceptions. As stated earlier, Biology is abstract by its nature and it makes difficulty in students biology learning, and for overcoming this obstacle, the teachers can use flow diagram or concept maps which will be helpful in showing the relationship between the two stages. It is also suggested that concept maps can be modified into activities which will make interesting and helpful to stop rote learning and enhance meaningful learning. Following prompting question can be used in constructing proper understanding the concepts.

Satilmis (2014) stated that students had misconceptions due to ineffective teaching method especially when the teachers followed the traditional method which does not provide any scope to understand the concept. Therefore, a constructivist teaching approach is useful to prevent and fix students' misconceptions. Constructivist theories support learning as a social improvement involving language, real world situations and cooperation among learners (Özer, 2004). Jean Piaget proposed that a constructivist education allows students to increase their ability to discover new ideas and construct new knowledge with regarding their personal interests and different level of intelligences (Özer, 2004). According to this theory, teachers should allow students to be in an effective learning environment in order to gain meaningful and persistent knowledge.

Mintzes et al. (2001) suggested that concept maps, Vein diagram, clinical interviews, portfolios and conceptual diagnostic tests can be used as a means to eliminate misconception in biological concepts. Michael (2002) concluded that providing opportunity for experiment in laboratory is a good way of eliminating misconceptions from the students. As reported by him 75% of the misconceptions can be eliminated by using this method in Biology teaching.

Perrone (2007) reported that children develop their concepts from their everyday life experiences and inquiry-based learning method which is useful as well as effective for addressing the misconceptions within the students.

5 Previous research on misconception and existing research gaps in Ethiopia

Exploring students' misconception in science started as research at late 1970s, and became more prominence at early 1980s (Taber, 2009). During this period, as briefly stated by Taber (2009), research groups based at the Universities of Waikato (New Zealand), Leeds (UK) and Surrey (UK) undertook extensive programs of research into children's ideas in science, and a range of seminal studies were published. These studies effectively initiated a research program into the nature of children's ideas; how they devel-

oped and how teachers should respond (Taber, 2009). The program was underpinned by a perspective on learning that is commonly referred to as constructivism. The interest in this area of research led to a number of books on children's ideas in science (Kind, 2004; Taber, 2009). In Ethiopia, it was the introduction of a new 'Master of Science Education (M. Ed)' post graduate program that exposed most post graduate students to the idea of students' misconceptions (Engida, 2002). However, as compared to studies conducted abroad, few studies were conducted in Ethiopia. Surprisingly, with regard to biological science misconceptions, only few studies were conducted i.e., Cell biology and cell division (Hailegebreil, 2014), photosynthesis and Cellular respiration (Basha et al., 2014), photosynthesis (Dagnew and Mekonnen, 2020 and Yenenesh et al., 2020), human anatomy (Dagnew and Endris, 2020) and human biology (Wodaj and Belay, 2021).

As reported by Peterson and Treagust (1989); Lee et al. (1993); Barker (1994), junior students have variety of misconceptions about the very basic biological concepts. However, few studies were conducted regarding to biological science misconception in junior secondary schools of Ethiopia. Furthermore, researchers suspected that those college, university students, and even teachers could have misconceptions about basic and advanced biological concepts from the very beginning which they have learnt in primary education before many years (Peterson and Treagust, 1989; Lee et al., 1993; Barker, 1994). However, no studies were conducted regarding biological science misconceptions at tertiary education levels of Ethiopia. Therefore, in attempt to bridging the above revealed gaps, there is a need to conduct research on biological Science misconceptions in primary, secondary and tertiary education levels of Ethiopia.

6 Conclusions

Misconceptions are deemed to occur when students' comprehension of a concept diverges from the scientific community's understanding. An examination of the literature underscores that everyday experiences, language usage, teachers, and textbooks play pivotal roles in contributing to students' misconceptions in biology lessons. Numerous studies conducted across different countries have delved into students' understanding of biological concepts. The identification of students' misconceptions holds paramount importance for effective teaching and learning in science. Various diagnostic tests, such as interviews, open-ended questions, multiple-choice questions, and multiple-tier tests, have been widely employed in science education research to measure and identify students' misconceptions. In order to enhance effective and meaningful learning, it is imperative to devise strategies for rectifying or preventing misconceptions based on their nature. While extensive research has been conducted internationally on biological science misconceptions, there is a noticeable dearth of research in the context of Ethiopia. Hence, there is an urgent need to undertake comprehensive research on biological science misconceptions at the primary, secondary, and tertiary levels of education in Ethiopia to address the identified gaps. Such endeavours are crucial for advancing science education and ensuring that teaching practices align with students' understanding, fostering a more accurate and comprehensive grasp of biological concepts.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

Data Availability

Data can be made available on the behavior of the request

Declaration of interests' statement

The author declare no competing interests.

References

Abraham, M. R., Grzybowski, E. B., Renner, J. W., & Marek, E. A. (1992). Understandings and misunderstandings of eighth graders of five chemistry concepts found in textbooks. *Journal of Research in Science Teaching*, *29*(2), 105–120.

Agnes, D., Kaniawati, I., & Danawan, A. (2015). Analisis deskriptif tes tiga tingkat materi optika geometri dan alat optik. *Prosiding Simposium Nasional Inovasi dan Pembelajaran Sains*, 597–600.

AlHarbi, N. N., Treagust, D. F., Chandrasegaran, A. L., & Won, M. (2015). Influence of particle theory conceptions on pre-service science teachers' understanding of osmosis and diffusion. *Journal of Biological Education*, *49*(3), 232–245.

Allen, M. (2010). Misconceptions in primary science.

Aniyah, S., et al. (2018). Misconception on transportation system of humans and plants.

Atilboz, N. G. (2004). 9th grade students' understanding levels and misconceptions about mitosis and meiosis. *Gazi University Journal of Gazi Educational Faculty (GUJGEF)*, *24*, 147–157.

Bahar, M. (2003). Misconceptions in biology education and conceptual change strategies. *Educational Sciences: Theory & Practice*, *3*(1), 55–64.

Barker, V. (1994). *A longitudinal study of 16-18-year-old students' understanding of basic chemical ideas* [Doctoral dissertation, University of York].

Basha, G., Wodajo, A., Menkir, S., & Alemayehu, Y. (2014). Conceptions and misconceptions of students about photosynthesis and cellular respiration in plants. *ZENITH International Journal of Multidisciplinary Research*, *4*(1), 259–272.

Bell, B. (1985). Students' ideas about plant nutrition: What are they? *Journal of Biological Education*, *19*(3), 213–218.

Boyes, E., & Stanisstreet, M. (1991). Misconceptions in first-year undergraduate science students about energy sources for living organisms. *Journal of Biological Education*, *25*(3), 209–213.

Boz, Y. (2006). Turkish pupils' conceptions of the particulate nature of matter. *Journal of Science Education and Technology*, *15*(2), 203–213.

Braund, M. (1998). Trends in children's concepts of vertebrate and invertebrate. *Journal of Biological Education*, *32*(2), 112–118.

Brown, C. R. (1990). Some misconceptions in meiosis shown by students responding to an advanced level practical examination question in biology. *Journal of Biological Education*, *24*(3), 182–186.

Butler, J., Mooney Simmie, G., & O'Grady, A. (2015). An investigation into the prevalence of ecological misconceptions in upper secondary students and implications for pre-service teacher education. *European Journal of Teacher Education*, *38*(3), 300–319.

Çakır, M. (2008). Constructivist approaches in science education.

Chinnici, J. P., Yue, J. W., & Torres, K. M. (2004). Students as "human chromosomes" in role-playing mitosis & meiosis. *The American Biology Teacher*, *66*(1), 35–39.

Cinici, A. (2013). Turkish high school students' ideas about invertebrates: General characteristics and classification. *International Journal of Environmental and Science Education*, *8*(4), 645–661.

Clark, D. C., & Mathis, P. M. (2000). Modeling mitosis & meiosis: A problem-solving activity. *The American Biology Teacher*, 204–206.

Cordero, R. E., & Szweczak, C. A. (1994). Teaching cell division.

Dagnew, A., & Endris, A. (2020). Model-based instruction to improve the concept of students on human anatomy: Primary school, ethiopia. *International Journal of Learning and Teaching*, *12*(2), 72–85.

Dagnew, A., & Mekonnen, D. (2020). Effect of using guided inquiry teaching method in improving grade eight students' concept of photosynthesis, primary school: Ethiopia. *International Journal of Innovative Research in Education*, *7*(1), 01–16.

Devetak, I., Vogrinc, J., & Glazar, S. A. (2007). Assessing 16-year-old students' understanding of aqueous solution at submicroscopic level. *Research in Science Education*, *39*, 157–179.

Dikmenli, M., Cardak, O., & Oztas, F. (2009). Conceptual problems in biology-related topics in primary science and technology textbooks in turkey. *International Journal of Environmental and Science Education*, *4*(4), 429–440.

Dreyfus, A., & Jungwirth, E. (1988). The cell concept of 10th graders: Curricular expectations and reality. *International Journal of Science Education*, *10*(2), 221–229.

Driver, R., Squires, A., Rushworth, P., & Wood-Robinson, V. (1994). *Making sense of secondary science: Research into children's ideas*. Routledge.

Engida, T. (2002). Analysis of the science process skills in high school chemistry textbooks. *IER FLAMBEAU*, *10*(1), 57–66.

Erman, E. (2017). Factors contributing to students' misconceptions in learning covalent bonds. *Journal of Research in Science Teaching*, *54*(4), 520–537.

Flores, F., Tovar, M. E., & Gallegos, L. (2003). Representation of the cell and its processes in high school students: An integrated view. *International Journal of Science Education*, *25*(2), 269–286.

Gabel, D. (1998). The complexity of chemistry and implications for teaching. *International Handbook of Science Education*, *1*(1), 233–248.

Griffiths, A. K., & Grant, B. A. C. (1985). High school students' understanding of food webs: Identification of a learning hierarchy and related misconceptions. *Journal of Research in Science Teaching*, *22*(5), 421–436.

Gudyanga, E., & Madambi, T. (2014). Pedagogics of chemical bonding in chemistry; perspectives and potential for progress: The case of zimbabwe secondary education. *International Journal of Secondary Education*, *2*(1), 11–19.

Hailegebreil, G. (2014). *Students' misconceptions about cell biology and cell division: The case of kelafo secondary and preparatory school, somali region, ethiopia* [Doctoral dissertation, Haramaya University].

Halim, A. S., Finkenstaedt-Quinn, S. A., Olsen, L. J., Gere, A. R., & Shultz, G. V. (2018). Identifying and remediating student misconceptions in introductory biology via writing-to-learn assignments and peer review. *CBE-Life Sciences Education*, *17*(2), 1–12.

Haslam, F., & Treagust, D. F. (1987). Diagnosing secondary students' misconceptions of photosynthesis and respiration in plants using a two-tier multiple choice instrument. *Journal of Biological Education*, *21*(3), 203–211.

Kaltakci, D., & Eryilmaz, A. (2010). Sources of optics misconceptions. *Contemporary Science Education Research: Learning and Assessment*, 13–16.

Kapici, H., & Akcay, H. (2016). Particulate nature of matter misconceptions held by middle and high school students in turkey. *European Journal of Education Studies*, *2*(8).

Keleş, E., & Kefeli, P. (2010). Determination of student misconceptions in "photosynthesis and respiration" unit and correcting them with the help of cai material. *Procedia-Social and Behavioral Sciences*, *2*(2), 3111–3118.

Kesidou, S., & Duit, R. (1993). Students' conceptions of the second law of thermodynamics—an interpretive study. *Journal of Research in Science Teaching*, *30*(1), 85–106.

Kibuka-Sebitosi, E. (2007). Understanding genetics and inheritance in rural schools. *Journal of Biological Education*, *41*(2), 56–61.
Kind, V. (2004). *Beyond appearances: Students' misconceptions about basic chemical ideas*.
Kindfield, A. C. H. (1994). Understanding a basic biological process: Expert and novice models of meiosis. *Science Education*, *78*(3), 255–283.
Kirbaslar, F. G., Baris, C. C., & Unal, M. (2009). A study on pre-service science teachers misunderstanding of fermentation. *Hacettepe Universitesi Egitim Fakultesi Dergisi*, *36*, 158–168.
Kılıç, D., & Sağlam, N. (2009). Development of a two-tier diagnostic test to determine students' understanding of concepts in genetics. *Eurasian Journal of Educational Research (EJER)*, (36).
Krüger, D., Fleige, J., & Riemeier, T. (2006). How to foster an understanding of growth and cell division. *Journal of Biological Education*, *40*(3), 135–140.
Kumandaş, B. (2015). Misconceptions about biology.
Kurt, H. (2013). Biology student teachers' cognitive structure on the concept of "immunity". *Dicle Universitesi Ziya Gokalp Egitim Fakultesi Dergisi*, *21*, 242–264.
Lee, O., et al. (1993). Cognitive research and elementary science instruction.
Lewis, J., Leach, J., & Wood-Robinson, C. (2000). Chromosomes: The missing link—young people's understanding of mitosis, meiosis, and fertilisation. *Journal of Biological Education*, *34*(4), 189–199.
Liu, X., & Li, L. (2013). Misconceptions in photosynthesis and respiration.
Marbach-Ad, G., & Stavy, R. (2000). Students' cellular and molecular explanations of genetic phenomena. *Journal of Biological Education*, *34*(4), 200–205.
Michael, J. (2002). Misconceptions—what students think they know. *Advances in Physiology Education*, *26*(1), 5–6.
Mintzes, J. J., Wandersee, J. H., & Novak, J. D. (2001). Assessing understanding in biology. *Journal of Biological Education*.
Munson, B. H. (1994). Ecological misconceptions. *The Journal of Environmental Education*, *25*(4), 30–34.
Nakiboglu, C. (2003). Instructional misconceptions of turkish prospective chemistry teachers about atomic orbitals and hybridization. *Chemistry Education Research and Practice*, *4*(2), 171–188.
Orbanic, N. D., Dimec, D. S., & Cencič, M. (2016). The effectiveness of a constructivist teaching model on students' understanding of photosynthesis. *Journal of Baltic Science Education*, *15*(5), 575.
Osborne, R. J., Bell, B. F., & Gilbert, J. K. (1983). Science teaching and children's views of the world. *European Journal of Science Education*, *5*(1), 1–14.
Özer, Ö. (2004). Constructivism in piaget and vygotsky. *The Fountain*, *48*.
Özmen, H. (2004). Some student misconceptions in chemistry: A literature review of chemical bonding. *Journal of Science Education and Technology*, *13*(2), 147–159.
Öztap, H., Özay, E., & Öztap, F. (2003). Teaching cell division to secondary school students: An investigation of difficulties experienced by turkish teachers. *Journal of Biological Education*, *38*(1), 13–15.
Pashley, M. (1994). A-level students: Their problems with gene and allele. *Journal of Biological Education*, *28*(2), 120–126.
Perrone, M. K. (2007). Addressing student misconceptions about reproduction and heredity. *Classroom Based Research Project, Eduauction*, 545–631.
Peterson, R. F., & Treagust, D. F. (1989). Grade-12 students' misconceptions of covalent bonding and structure. *Journal of Chemical Education*, *66*(6), 459.
Putri, L. A., et al. (2017). Analyzing concepts mastery and misconceptions about evolution of biology major students. *Journal of Physics: Conference Series*, *812*(1), 012083.
Riemeier, T., & Gropengießer, H. (2008). On the roots of difficulties in learning about cell division: Process-based analysis of students' conceptual development in teaching experiments. *International Journal of Science Education*, *30*(7), 923–939.

Saka, A., Cerrah, L., Akdeniz, A. R., & Ayas, A. (2006). A cross-age study of the understanding of three genetic concepts: How do they image the gene, dna and chromosome? *Journal of Science Education and Technology*, *15*(2), 192–202.

Sanders, M. (1993). Erroneous ideas about respiration: The teacher factor. *Journal of Research in Science Teaching*, *30*(8), 919–934.

Satilmis, Y. (2014). Misconceptions about periodicity in secondary chemistry education: The case of kazakhstan. *International Online Journal of Primary Education*, *3*(2), 53–58.

Sesli, E., & Kara, Y. (2012). Development and application of a two-tier multiple-choice diagnostic test for high school students' understanding of cell division and reproduction. *Journal of Biological Education*, *46*(4), 214–225.

Skelly, K. M., & Hall, D. (1993). The development and validation of a categorization of sources of misconceptions in chemistry. *Third International Seminar on Misconceptions and Educational Strategies in Science and Mathematics*.

Smith, M. U. (1991). Teaching cell division: Student difficulties and teaching recommendations. *Journal of College Science Teaching*, 28–33.

Smith, M. U. (1999). Teaching cell division: Basics & recommendations. *The American Biology Teacher*, *61*(5), 366–371.

Smith III, J. P., DiSessa, A. A., & Roschelle, J. (1994). Misconceptions reconceived: A constructivist analysis of knowledge in transition. *The Journal of the Learning Sciences*, *3*(2), 115–163.

Stevens, A. M., Smith, A. C., Marbach-Ad, G., Balcom, S. A., Buchner, J., Daniel, S. L., & Yarwood, S. A. (2017). Using a concept inventory to reveal student thinking associated with common misconceptions about antibiotic resistance. *Journal of Microbiology & Biology Education*, *18*(1), 18–1.

Stewart, J., & Dale, M. (1989). High school students' understanding of chromosome/gene behavior during meiosis. *Science Education*, *73*(4), 501–521.

Suniati, N. M. S., Sadia, I. W., & Suhandana, G. A. (2013). Pengaruh implementasi pembelajaran kontekstual berbantuan multimedia interaktif tehadap penurunan miskonsepsi. *Jurnal Administrasi Pendidikan Indonesia*, *4*(1).

Taber, K. S. (2009). Challenging misconceptions in the chemistry classroom: Resources to support teachers. *Educació Química*, 13–20.

Taufiq, L., Sriyati, S., & Priyandonko, D. (2017). Students' conceptual change on human reproduction concept using scientific approach. *International Journal of Science and Applied Science: Conference Series*, *2*(1), 216–226.

Tekkaya, C. (2002). Misconceptions as barrier to understanding biology. *Hacettepe Universitesi Egitim Fakultesi Dergisi*, *23*(23).

Tekkaya, C., & Yenilmez, A. (2006). Relationships among measures of learning orientation, reasoning ability, and conceptual understanding of photosynthesis and respiration in plants for grade 8 males and females. *Journal of Elementary Science Education*, *18*(1), 1–14.

Treagust, D. F., Chittleborough, G., & Mamiala, T. (2003). The role of submicroscopic and symbolic representations in chemical explanations. *International Journal of Science Education*, *25*(11), 1353–1368.

Trowbridge, J. E., & Mintzes, J. J. (1988). Alternative conceptions in animal classification: A cross-age study. *Journal of Research in Science Teaching*, *25*(7), 547–571.

Tyson, L., Treagust, D. F., & Bucat, R. B. (1999). The complexity of teaching and learning chemical equilibrium. *Journal of Chemical Education*, *76*(4), 554–558.

Vitharana, P. R. K. A. (2015). Student misconceptions about plant transport–a sri lankan example. *European Journal of Science and Mathematics Education*, *3*(3), 275–288.

Waheed, T., & Lucas, A. M. (1992). Understanding interrelated topics: Photosynthesis at age 14+. *Journal of Biological Education*, *26*(3), 193–199.

Wahyono, P., & Susetyarini, E. (2021). Misconceptions of biology education students in biochemistry course during the covid-19 pandemic. *Journal of Biological Education Indonesia (Jurnal Pendidikan Biologi Indonesia)*, *7*(2), 104–110.

Widarti, H. R., Permanasari, A., & Mulyani, S. (2016). Student misconception on redox titration (a challenge on the course implementation through cognitive dissonance based on the multiple representations). *Jurnal Pendidikan IPA Indonesia*, *5*(1), 56–62.

Widyatmoko, A., & Shimizu, K. (2018). Literature review of factors contributing to students' misconceptions in light and optical instruments. *International Journal of Environmental and Science Education*, *13*(10), 853–863.

Wodaj, H., & Belay, S. (2021). Effects of 7e instructional model with metacognitive scaffolding on students' conceptual understanding in biology. *Journal of Education in Science, Environment and Health (JESEH)*, *7*(1), 26–43.

Yenenesh, W., Nega, T., & Dessalegn, E. (2020). Effectiveness of concept mapping teaching method on grade 8 students' conceptual understanding of photosynthesis at ewket fana primary school, bahir dar, ethiopia. *EURASIA Journal of Mathematics, Science and Technology Education*, *16*(2), 1–16.

Yeşilyurt, S., & Kara, Y. (2007). The effects of tutorial and edutainment software programs on students' achievements, misconceptions and attitudes towards biology on the cell division issue. *Journal of Baltic Science Education*, *6*(2), 5–15.

Yip, D. Y. (1998). Identification of misconceptions in novice biology teachers and remedial strategies for improving biology learning. *International Journal of Science Education*, *20*(4), 461–477.

Yücel, E. Ö., & Özkan, M. (2015). Determination of secondary school students' cognitive structure, and misconception in ecological concepts through word association test. *Educational Research and Reviews*, *10*(5), 660–674.

Ethiopian Journal of Education Studies
OPEN ACCESS
ISSN(online): 27892875
Web link: https://journals.hu.edu.et/hu-journals/index.php/eies/

Original Article

Dynamic factors affecting undergraduate health Science Students' Learning Engagement, Academic Performance and Achievement at Hawassa University, Ethiopia

Girma Moti Geletu [1], Mekdes Mekonnen Belay [2*] and Bachu Taye Welteji [3]

[1,2,3] College of Health Science and College of Education, Hawassa University

ARTICLE INFO

Volume I, Issue I (2023)
https://doi.org/10.20372/9km7an91

CORRESPONDING EMAIL
* Corresponding author:
emailmekdibelay@yahoo.com

ARTICLE HISTORY
Submitted: 11 Feb, 2023
Accepted: 15 Jul, 2023
Published Online: 31 Jul, 2023

CITATION
Geletu, G.M., Belay, M.M. and Welteji, B.T. (2023). Dynamic factors affecting undergraduate health Science Students' Learning Engagement, Academic Performance and Achievement at Hawassa University, Ethiopia. *Ethiopian Journal of Education Studies*. Volume I, Issue I (2023), 15-33. https://doi.org/10.20372/9km7an91.

OPEN ACCESS
TThis work is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

KEYWORDS:
Learning engagement;
factors;
academic performance and achievement;
in-campus and off-campus factors;
motivation and willingness;
educational process-inputs-outputs

Abstract

The study investigated dynamic forces affecting undergraduate health science students' learning engagement, academic performance and achievement. The study employed mixed method with embedded mixed design. A total of 238 participants were selected using availability sampling, simple and stratified random sampling techniques. Questionnaires, focus group discussion, observation and document analysis were used to collect data. The data collected through questionnaires were analyzed using descriptive and inferential statistics and those collected through focus group discussion, document review and observation were qualitatively narrated. The findings of the study revealed that although there were many attempts to enhance students' learning participation and academic performance, the in-campus and off-campus dynamics have contributed to learning engagement, academic performance and achievement of health science students. The demographic factors such as gender, family education and socio-economic status, quality of previous high school, student's admission point and medium of instruction played significant roles in determining students' learning, performance and achievement. The willingness, motivation, commitment and competences of students, instructors and management bodies were crucial dynamic factors contributing to academic performance of students. Improving the qualities of educational inputs, educational processes, support staff services and curriculum materials should improve to quality of students' learning participation, academic performance and achievement.

1 Introduction

Education as a complex system rooted in the society's economic, political and socio-cultural context that prepares the needed workforce with proficiency, competences and techniques required to transform global economies (Kipkebut, 2010). Excellence in education, curriculum, school and teaching philosophies demand dialogic and collaborative forms of practices and prominent contextualization of innovative ideas of teachers and

learners (Al-Balushi, 2017; M. G. Girma, 2022). The education system is one of the fundamental engines for development which gears towards economic development, stability and progress. The growing of international competitions, accountabilities, responsibilities, academic and professional competencies call for changes and respond to rapid changes occur in the learning environments because higher education makes significant changes driven by globalization and technology (Mense, 2018). Accordingly, one of the objectives of Ethiopian education policy in general and higher education in particular is to satisfy the country's need for skilled manpower by providing training in various skills and at different educational levels (Ministry of Education, 2018) because the success and development of the country would greatly depend on the productivity of its human capital. The dividing line between developed and developing countries relies on the capacity of higher education, scientific attainments and its application for economic progress and prosperity (Bloom et al., 2005). Therefore, the increasing practices of investments on higher education contribute to international organizations and communities.

The call for quality education emerged as almost a policy campaign to produce competent manpower resources and provide intensive training required for students to become skilled and productive workers when they become parts of the labor force (Rommel, 2004). The present era is characterized by a historical move towards mass higher education that intends to secure place for students of different socio-economic background. This ideological move is dramatically increasing the number of students beyond the existing capabilities of higher education institutions in terms of human, material and financial resources at their disposal. In higher education institutions, nothing can be taken on trust and the students have to think themselves (Barnett, 1997) through discovery and active participation in the experiences of knowledge creation and transformation (Kurt, 2020).

Higher education imparts the deepest understanding in the minds of students rather than superficial grasp that might be acceptable elsewhere in the system. The students' learning, academic performance and achievement play an important role in producing the best quality graduates who will become great leader and manpower for the country and thus, responsible for the country's economic and social development (Ali et al., 2009). The qualities of students' academic gain and learning performance are affected by numerous factors including gender, age, teaching faculty, students schooling, guardian SES, residential area of students, medium of instruction in schools, tuition trend, daily study hour and accommodation as day scholar (Waters and Marzano, 2006). Some empirical studies have been made to examine significant relationships between independent variables in terms of grades or degree completion, and dependent variable (academic success of students) at University level although the results have not been entirely satisfactory.

Some major independent variables affect academic performance of higher education institutions' students. This includes university management, facilities and quality of instructional processes: quality of instructors, instructional materials, methods of teaching, assessment techniques are among the many (Amin, 2005). These variables are part of the inputs and processes (independent or manipulative variables) which play fundamental roles to contribute to the outputs-academic performance and achievement (dependent variable). Moreover, educational institutions take inputs from the learning environments, undergo educational process, and convey outputs to the learning environment (Shavelson, 1987). The university admits students (inputs) and then transforms them through teaching and learning which is reflected by the students' academic performances (outputs). The types of contexts such as target knowledge, skills and dispositions, organization and facilitation of educational process determine the capacity of institutions (Egert et al., 2018). Therefore, quality inputs via quality educational process produce quality outputs in the learning systems based on the input-process-output standards and indicators.

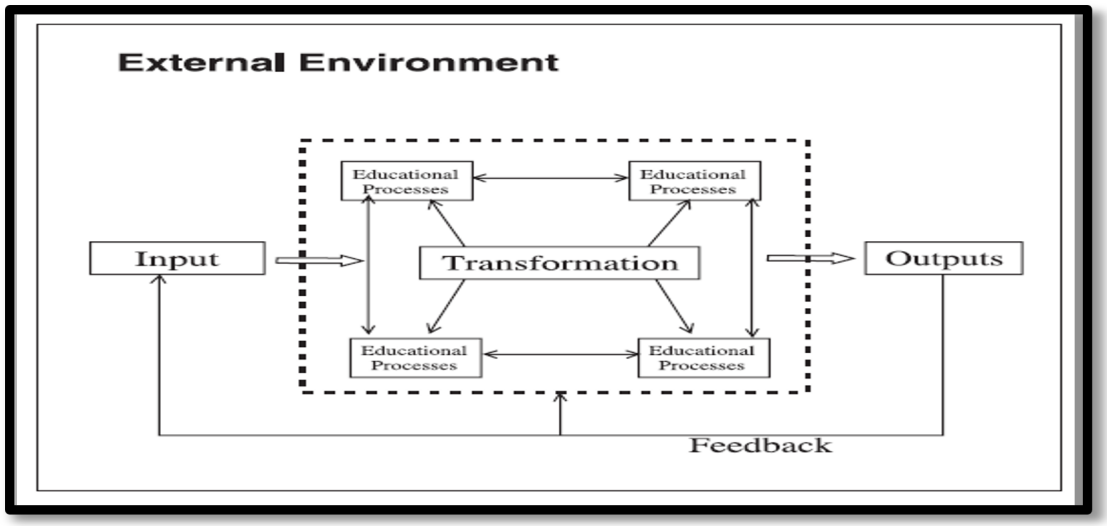


Figure 1: Systems view model of quality in education

According to Minnesota measures (2007), a report on higher education performance which was produced by the University of Minnesota, the most reliable predictor of student success in college is the academic preparation of students in high school. Similarly, Geiser and Santelices (2007) found out that high school grade point average is consistently the best predictor of the success of college students. This indicates that high school grades were without doubt the best predictors of academic performance. Academic performance as a dependent variable related to independent variables-admission points. Accordingly, if the admission points are high, then the academic performance is likely to be high and if admission points are low, then academic performance may be low (Geiser and Santelices, 2007). In the Ethiopian context, a national assessment made on EGSECE, for example, indicated poor achievement of students in English and other subjects (National Examination Agency, 2007).

In the same manner, some studies of EGSECE achievement of students in secondary schools reported poor performance of students in English language and mathematics (Amare, 2009). This poor performance in English language as a medium of instruction hindered understanding of information and communication system in higher education institutions. The previous performance affects the future academic performance of students whether the HEIs education quality, graduates' satisfaction, and employers' perceptions have been affected as a result of the past and current assessment methods (Moges, 2018).

In addition, Dills (2006) suggested that students' learning engagement and academic performance are dependent on parents' SES remarking that students from high socio-economic backgrounds perform better than their counter parts from low social economic backgrounds. Likely, it is evident that students from educated family are better perform than students from non-educated families. Students' learning, academic performance and achievement depend on number of socio-economic factors like students' attendance in the class, family income, mother's and father's education, teacher-student-ratio, presence of trained teacher in school, sex of a student, and distance of schools (Raychaudhuri et al., 2010). In line with this, Hansen and Mastekaasa (2006) argued that according to the cultural capital theory one could expect students from families who are closest to the academic culture to have greatest success. A similar view is held by Kolicic (2006) on academic performance and scientific involvement of final year medical students coming from urban and rural backgrounds and concludes that students from urban backgrounds had significantly better academic and research indicators than those from rural and re-

mote backgrounds.

The other independent variable is former school background, which was conceptualized as location of the former school (urban or rural); ownership of former school (public or private) academic status of the former school and financial status of the former school is linked to academic performance of students. In light of this, students from high-class schools are likely to perform well because they attended those schools (Sentamu, 2003 & Kweisga, 2002). Thus, the type of school a student attends is likely to contribute to their future learning and academic performance.

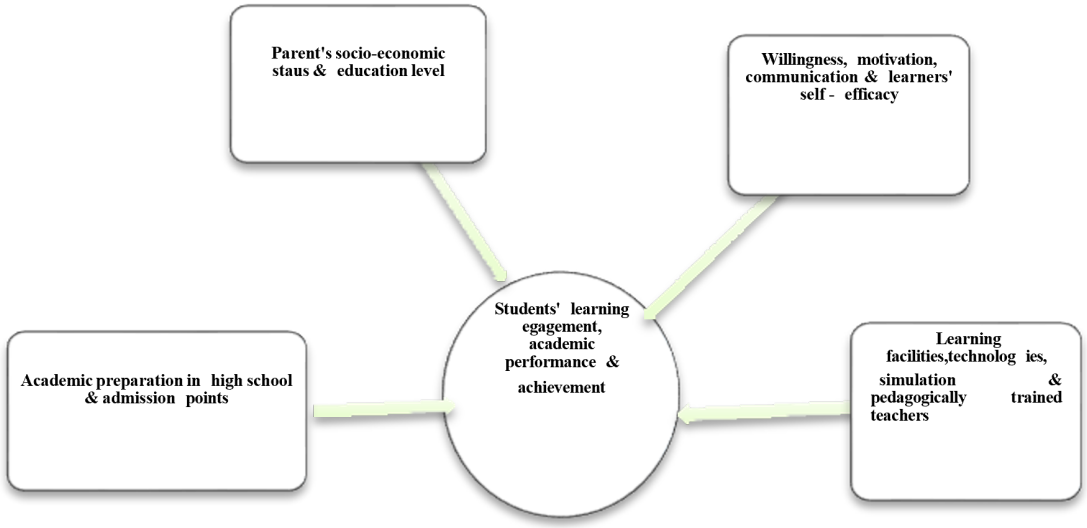


Figure 2: Models showing dynamic factors contributing to students' learning and academic performance

2 Research problem

The current educational market seems to pose new dominating expectation about the roles and practices of higher education institutions in producing high quality work force equipped with necessary market oriented practical skills (Leu, 2000). The graduates' profiles to be attained in terms of desired skills, knowledge and understanding, social and economic needs of the country are at the heart of quality assurance process. Quality demands quality to accomplish the mission scrutinizing the echelon of higher education institutions' students' learning from knowledge acquisition to knowledge application (Amare, 2009). Economic growth and development are unthinkable without having skilled citizens come out of competitive type of education provided by universities in knowledge-based era. When Ethiopia is moving to stand among middle income countries and contributes to the achievement of 2030 programs, education takes the leading focus. For instance, the practices of SDG-3 good health and well-being, and SDG-4 ensuring inclusive and equitable quality education (UNESCO, 2019) are priority areas in the development of Ethiopia.

In order to overcome deep rooted problems of health workforces following efforts were exerted to achieve highly agreed up on MDGs (United Nations, 2015). Ethiopia has implemented the globally planned MDGs and GTP to stand among middle income countries by 2015 and 2020 respectively (i.e. improving maternal health by 66.67% and reducing children mortality by 33.33%, and combating tropical diseases, HIV/AIDS and TB) are some of the "mottos" for which health professionals were working. Educational preparation of health science students, who contribute primarily towards the health of the community,

needs unquestioned attention underlying improving the health of the society (Sunshine and Lawrence, 2015). With this intention, producing competent health professionals in higher education institutions is the best instrument to full fill the gaps with respect to quantity and quality of health professionals in our country. Thus, higher education learning institution's mission completion through combined effects of teaching-learning, research and innovation created large magnitude of entities towards organizational performance (M. Girma and Akliu, 2023).

Academic success has a great influence on a student's self-esteem, motivation, and perseverance in higher education. Unlikely, poor academic performance results in unacceptable levels of attrition reduced graduates (outputs) and increased cost of education. Likewise, in the Ethiopian context, Amare and Temechen (2002) pointed out that the profile of graduates from different educational programs has been under attack by employers and researchers and hence, the problem-solving graduates were rarely observed. Similarly, the qualitative exploration was administered to identify factors that affect academic performances of students and generated number of factors such as psychosocial factors, environmental and conditions of the areas (Valli and Santhi, 2014). This study had not addressed and reflected the roles of inputs and processes in bringing outputs (academic performance). Educators and researchers have been interested in identifying and understanding the variables that contribute to academic excellence because students' academic performance has always been a topic of interest for educators. Therefore, the proportion of graduates with academic success and won the competences (knowledge, skills, abilities and attitudes) decline from time to time because of dynamics associated to quality of educational inputs including teacher professional and pedagogical competencies, process associated to methods of teaching and assessment, and outputs linked to student's learning engagement in classrooms and academic performance (M. G. Girma, 2022).

In the Ethiopian context, there were few studies done on problems of students' profiles such as learning engagements, academic performances and achievements at higher education institutions (e.g. Amare, 2009; Amare and Temechen, 2002; M. G. Girma, 2022; National Examination Agency, 2007; L. Wariyo and Asgedom, 2021). The mentioned studies revealed the profiles of graduates such as learning engagements, academic performances and achievements of students surrounded by number of factors, of which factors associated to inputs-processes-outputs are perplexing paradoxes. However, as far as the knowledge's of the researchers were concerned, no study has been conducted on the current issue in the study area.

2.1 Research questions

1. What major in-campus and off-campus dynamic forces are affecting undergraduate health science student's learning engagement, performance and achievement?
2. To what extent are undergraduate health science students ready to learn competently to improve their participation, academic performance and achievement?
   (a) What are the impacts of admission criteria, SES, former school, family education, age, sex and competences in campus on student's learning, performance and achievement?
   (b) What does the current level of student's learning participation, performance and achievement looks-like?
3. To what extent are educational facilities accessible to run instructional process effectively and promote learning, academic performance and achievement of undergraduate health science students?
4. To what extent are instructors competent in their subject matter knowledge and pedagogical skills to carry out teaching-learning process effectively?

5. To what extents are the teaching-learning process (course coverage, students' attendance, teaching strategies, assessment techniques, workshops, libraries and laboratories) occurred to advance students' learning?

2.2 Objectives

Based on the stated problem, the study has the following objectives. These are to:

1. Identify major in-campus and out-campus dynamic forces affecting undergraduate health science student's learning engagement, performance and achievement.
2. Pinpoint the exact status of undergraduate health science students' learning participation, academic performance and achievement.
3. Evaluate the application of different pedagogical strategies in instructional processes with respect to students' academic performance and achievement
4. Examine the responsibilities of instructors, school directors and department heads in light of advancing learning participation, academic performance and achievement of students.
5. Evaluate the competences (knowledge, skills & attitudes) of the health science students with respect to their future duties.

2.3 Significance

The study has policy, social, academic and practical significance to improve and maintain quality of education for-and-against the established standards and indicators depending on IPO system model. This conceptually broad and depth study is essential to improve quality of teachers at the center of educational system and contributes to inclusive and equitable quality of teaching-learning process and contributes to producing competent and skillful learners and a source for future research.

3 Research Methods

3.1 Research design

A mixed method with embedded (QUAN+qual) mixed design were employed with the intention of getting necessary information about in-campus and off-campus dynamic forces affecting learning participation, academic performance and achievement of undergraduate health science students. The design is considered embedded because quantitative data results are explained further with the qualitative data (Creswell, 2014). The mixed method is an approach to inquiry involving collecting both quantitative and qualitative data, and integrating the two forms of data and using distinct designs that may involve philosophical assumptions and theoretical frameworks. Hence, Creswell and David (2018) stated that mixed design assists researchers to collect both numerical and non-numerical data, analyze, interpret and give meaning for deeper understanding of the research problem simultaneously.

3.2 Sources of data

The primary sources were school directors, department heads, instructors, technicians and students whereas the secondary sources of data were instructional materials and CGPA of students, ensures data triangulation and enrichment (Creswell and David, 2018). Thus, the primary and secondary data were collected regarding in-campus and off-campus factors affecting academic performance and achievement of undergraduate health science students.

3.3 Samples and sampling techniques

College of Medicine and Health Science in Hawassa University was selected using purposive sampling technique because of experiences and professional background of the researchers. The researchers determined a sample size for the large target population (e.g. students) using Cochran (1977) to decide the numbers of representative sample students. n

$$= \frac{N}{1 + N(e)2}; \text{n} = \text{required sample size}, \text{N} = \text{Total}$$

Population size = 237, CI = Level of confidence interval 95%, e = Margin of error = 0.05%, n = 148 students.

Table 1: Population and sample size of the study by departments (n = 238)

Department Units	Students	Instructor		Coordinator		Lab-technicians	
		N	n	N	n	N	n
Clinical Nursing	45	3	1	2	3	1	5
Midwifery	37	2	6	1	5	1	0
Optometry	16	1	0	1	0	6	2
Environmental Health	19	1	2	1	1	7	2
Public Health	65	3	5	2	2	1	5
Pharmacy	28	1	9	1	0	6	1
Medical Laboratory	27	1	5	1	0	7	2
Total	**237**	**14**	**8**	**10**	**16**	**6**	**15**

Note: N = Population, n = Sample selected

3.4 Data collection tools

The data collection tools were questionnaires, focus group discussion, observation and document analysis. Creswell and David (2018) stated that employing multiple data collection instruments help the researchers to combine and strengthen inadequacies and keep triangulation of data. The researchers preferred questionnaires because it is easier to handle and simple for respondents to answer within short period of time (Koul, 2008). The researchers believed that instructors and senior students could easily understand the concept and objectives of the study. Thus, 5-point likert scale closed-ended questionnaires, unstructured interview and focus group discussion guiding questions, document examination coded sheet and observation checklist were prepared in English because it is a medium of instruction in HEIs.

3.5 Validity and reliability

The validity of data collection instruments were checked by expert reviewers and a pilot test was conducted on none sample respondents to ensure the reliability of instruments. The collected data were calculated using Chronbach alpha and resulted in reliability coefficient, .853 and .861 for instructors and students, respectively (p is significant at $\alpha > 80$). Based on comments of reviewers and calculated figures, clarification and modification were made on few items of questionnaires. Finally, after final data analysis, the reliability coefficients were again calculated and were .878 and .867 for instructors and students respectively.

3.6 Methods of data analysis

Creswell (2014) states that mixed method help to achieve what is termed triangulation where comparison between different databases could be made for better effect. Mixing of the two types of data, qualitative and quantitative is made at the interpretation or discussion to actually merge the data. This means to transform one type of data to the other type and compare the results of two databases side by side in a discussion. The data collected through questionnaires were analyzed using appropriate descriptive and inferential statistics such as frequency, percentage, average mean, standard deviation and two-tailed t-test using SPSS-26. The qualitative data obtained through interviews, FGD and document analyses were organized and analyzed using NVivo-14.

3.7 Ethical practices

Ethical approval for this study was obtained from CMHS to avoid the research misconduct because harm is narrated in the context of institutional characteristics, policies, procedures, guidelines and work environment (Petousi and Sifaki, 2020). Before distributing the instruments to the participants for data collection, permission was sought from education administration offices.

4 Results

4.1 Demographic characteristics of respondents

A total of 238 participants: 214 participants were engaged in filling out questionnaires, 9 participants were engaged in interview and 15 discussants were participated focus group discussion.

Table 2 shows that 61 (68%) of the sampled academic staffs, 107 (72%) of Undergraduate students were males whereas 29 (32%) of academic staffs and 41(28%) of undergraduate students were females. Therefore, there is slightly low participation of females compared to their male counter parts. Regarding qualification of academic staffs, 55 (61%) of instructors were MSc degree holders whereas 34 (38%) of them were PhD holders. Thus, the educational qualification of teaching staffs was below the essential required minimum standard (Ministry of Education, 2018). Low qualification of teaching staffs appears unlikely to conduct instructional process effectively. This calls for inferior quality of education because teachers' professional development and educational qualification have paramount importance to promote quality of education. However, 69 (76%) of academic staffs have 11-20 years teaching experiences which is promising in improving quality of

education which helps to enhance students' academic performance. However, 15 (17%) instructors have 5-10 years teaching experiences which have significant impact in handicapping learning engagement, academic performance and achievement of students. All of the academic staffs are full-time workers which is good to give attention to the competences of students.

Table 2: Demographic characteristics of respondents (n = 238)

Variables	**Characteristic**	**Academic Staffs**		**Students**	
		F	%	F	%
Sex	Male	61	68	107	72
	Female	29	32	41	28
	Total	90	100	148	100
Qualification	Ass. Professors	3	4	All are 4th year students	
	MSc	55	61		
	BSc	1	1		
Work Experiences	5-10	15	17	All are 4th year students	
	11-15	34	38		
	16-20	4	4		
	≥21 years	6	7		
	Total	90	100		
Terms of Employment	Full-time	90	100	All are regular 4th year students	
	Total	90	100		

Table 3: Relationships between demographic profiles & academic performances of students

Demographic Variables	**Instructors**		**Student**		**t-test**	**p-value**
	M1	SD1	M2	SD2		
Gender	4.0	0.52	3.41	1.38	1.52	.712
Age	2.8	0.59	2.55	0.59	2.10	.214
Family SES	4.1	0.43	3.92	0.42	7.21	.000
Family education level	3.2	0.39	3.78	0.39	6.84	.000
Residential areas of students	2.1	0.55	1.85	0.61	1.55	.141
Students' admission points	3.4	0.44	3.21	0.53	9.18	.000
Medium of instruction	3.2	0.42	3.55	0.44	1.19	.237

Table 3 shows the average mean of items 1, 2, 5, 7 and 8 were above the expected ideal mean (3.00) which remarks that the relationships between the variables. The statistically significance differences between the views of respondents by the t-values at (1.70, 1.94, 1.55, 1.96 & 1.19) respectively are greater than alpha value ($p > .05$). This shows that there are statistically significant differences between the opinions of the two categories of respondents. On the other hand, the average mean values of items 3, 4 & 6 were above the expected ideal mean which reflects the existence of strong relationships between the variables. The statistically significance differences between the views of respondents by the t-values at (7.21, 6.84 & 9.18) respectively are less than alpha value ($p < .05$). This shows that there are statistically significant differences between the opinions of the two categories of respondents. Therefore, these are serious factors that affect students' learning engagement, academic performance and achievement. In addition, the teams of group focus discussants stated that Table 4 shows the average mean values of item 1 was above the expected ideal mean which remarks that the participation of students in problem-based learning and their motivation to learn from professional practices and projects were encouraging. There is no a statistically significance difference between the views of respondents by the t-values at (1.88) is greater than alpha value ($p > 0.05$). This

shows that there is no a statistically significant difference between the opinions of the two categories of respondents. The average mean values of items 5, 6 and 10 were above the ideal average mean by instructors and below the ideal average mean by students. This shows that teachers ensure instructors' willingness to capacitate their students through different projects and conduct researches to rank students' academic performances were encouraging. But students responded that they were not satisfied with instructors' willingness. The significance difference between the views of respondents by the t-values at (7.71, 4.29 & 6.58) are less than the alpha value ($p < 0.05$). This shows that there are statistically significant differences between the opinions of the two categories of respondents. On the contrary, the average mean values of items 2, 3, 4, 7, 8 & 9 were below expected ideal mean (3) which reflects that students' attend classrooms regularly and motivated to learn from the experiences of health professionals. The significance difference between the views of respondents by the t-values at (2.34, 1.24, 1.38, 1.67, .238 & 1.44) are greater than alpha value ($p > 0.05$). This shows that there are no statistically significant differences between the opinions of the two categories of respondents.

Table 4: Willingness and motivation of the instructor, students and management bodies

Items	**Instr**
	M1
Students attend the classroom regularly	3.54
Students participate in problem-based learning	2.82
Students' motivation to learn from professional practices and projects	2.67
Students' willingness and inspiration to learn from reading materials	2.57
Instructors' willingness to capacitate their students through different projects	3.58
Instructors' commitment to make students enthusiastic professionals	2.75
Instructors' willingness to improve pedagogical knowledge through HDP training	2.88
Management bodies' motivation to fulfill reading materials	2.95
Management bodies' motivation to fulfill computers and internet services	2.79
Management bodies' commitment to initiate academic staffs to conduct research projects	3.86

In addition, one of the interviewees suggested that 'I think students learn more from projects, field experiences and experiential learning if and only if they have motivation and commitment. However, I assume that instructors and department coordinators show less commitment to make students enthusiastic professionals on top of student's less interest to learn from different instructional materials. I am sure that instructors should carefully design problem-based learning to their students' (IW-3, 14 April 2021).

Moreover, the document examination (eg. instructional plan, HDP portfolios) result shows that the management bodies initiate academic staffs to conduct research projects and implement problem-based learning to improve instructional processes and give community services though there was no participatory action research practices to improve classroom pedagogical strategies (Document Examination, April, 2021).

Table 5: Competences (knowledge, skills or abilities) of students

Items	Instructor	
	M1	SD1
Students' academic background knowledge	2.94	0.56
Students' quality in their subject matter knowledge	2.74	0.52
Students' knowledge about the apparatuses and instruments of the skills laboratory	2.88	0.48
Students' abilities to undertake professional projects	2.94	0.45
Students' communication and understand the subject matter	2.64	0.84
Students' computer skills to grasp new information	2.85	0.53
Students' skills to transform theories into practice	2.89	0.56
Students' interest to practice professional projects	2.78	0.56
Students' skills in using apparatus and instruments in skills laboratory	2.85	0.54

Table 5 shows that the average means of items 4 and 5 were rated above and below the ideal average mean (3) by instructors and students. There are no significant differences between the views of respondents by the t-values at (1.99 & 1.84) were greater than the alpha value ($p > 0.05$). This shows that there are no significant differences between the opinions of the two categories of respondents. On the other hand, items 1, 2, 3, 6, 7, 8 & 9 were rated above and below the ideal means. There are significant differences between the categories of respondents by the t-values at (2.15, 13.98, 11.69, 11.28, 2.17, 13.74 & 10.95) were less than the alpha value ($p < .05$).

Furthermore, one of the interviewees suggested that student's quality in subject matter knowledge and skills are determined by how much they learned using different instructional materials and styles. The interviewee said: "I believe that students' knowledge and skills associated to laboratory apparatus, skills and interests to practice professional practice in laboratory or via problem-based project are indisputable to ensure quality of science learning. However, students' efforts and practices to develop professional competencies and skills required in the 21st century are not encouraging. I think it is encouraging to motivate teachers and students to work differentiated instruction and different learning styles and strategies" (IW4, 24 April, 2022).

...The document analysis finding ensures that the evaluation of instructional planning indicated that although some teachers use various teaching methodologies, the majority lack competencies pedagogy, and hence some are participating in fragmented HDP training program (Document Review, March, 2021).

On the other hand, one of the focus group discussions stated that

I myself as a department head is not satisfied with the application of active learning strategies in classrooms to ensure two-way communication while transforming scientific theories into practice via laboratory, problem-based projects, experiential learning and HDP training (D7)....I (D9) further stated that the practice of active learning and continuous assessment were fragmented from time to time because of lack of continuous training' (FGD-2, 18 March 2021).

Table 6: Qualities of educational inputs

Items	Instructors		Students		Sig(2-taile
	M1	SD1	M2	SD2	
Instructors to student ratio is around 1:30	2.70	0.58	2.80	0.48	1.79
Computer to student ratio is around 1:25	2.85	0.52	2.80	0.52	1.64
Lab-technician to student ratio is 1:15	2.66	0.54	2.80	0.54	2.09
Course materials to students ratio is 1:1	3.85	0.49	3.50	0.58	1.37
Full time/part-time instructors ratio: 70:30	4.54	0.14	3.90	0.28	0.49
Qualification PhD/specialist: MSC/generalist ratio: 25:75	2.68	0.44	2.80	0.52	1.68
Adequate clinical sites for apparent ship	2.82	0.59	2.60	0.57	0.76
Enough rooms for simulation training	3.43	0.41	3.90	0.29	1.97

Table 6 shows the average mean of items 1, 2, 3, 6 & 7 were rated below the expected ideal mean by instructors and students. There are no statistically significant differences between the views of respondents by the t-values at ($p > .05$). On the other hand, 4, 5 & 8 were rated above the expected ideal mean by instructors and students. There are no significant differences between the views of respondents by the t-values at ($p > .05$).

In addition, one of the interviewees suggested that

I know that there are attempts of fulfilling educational inputs but it does not fit to the quality standards and indicators of ETA/HERQA. The ratios of educational inputs to students are very large to provide appropriate services to students. The number of instructors is large enough and best qualification to ensure quality of the teaching and learning process' (IW-1, 19 April 2021).

The document examination and observation the educational inputs such as computer, laboratory equipment and clinical sites are optimum. However, the number of students is large compared to the existing human and material resources, and contradicts with the indicators of ministry of education road map policy document (Document Examination, April, 2021).

...Similarly, the observation results show that

Table 7: Qualities of instructional processes

Items	
Instructors cover curriculum contents in quantity and quality on time	3
Instructors use various active learning methods in classrooms	2
Instructors use performance-based assessment techniques to assess students' competences	2
Instructors demonstrate practical activities in clinical site/lab skills for students	3
Instructors make enough preparation of lesson	3
Instructors have excess time to give technical support, standardized and feedbacks to students	2
Instructors use appropriate medium of instruction	3
Instructors take simulation training as educators of health care	3
Instructors adjust tutorial supports to overcome instructional problems	2

Table 7 shows the average mean of items 1, 4, 5, 7 & 8 were rated above the expected ideal mean by instructors and students. There are no significant differences between the views of respondents by the t-values at (1.32, .789, .898 & 1.35) were less than the alpha value ($p < 0.05$). This shows that there are no statistically significant differences between the opinions of the two categories of respondents. On other hand, the average

mean of items 2, 3, 6 & 9 were rated below the ideal average mean by instructors and students. There are no significant differences between the views of respondents by the t-values at (2.07, 1.96, 1.45, 1.35 & 6.78) greater than the alpha value ($p > .05$). This shows that there are no statistically significant differences between the opinions of the two categories of respondents. Therefore, these are serious factors that affect students' learning participation, academic performance and achievement.

.... In addition, the document analysis shows that

There are efforts and willingness to implement various active learning strategies, performance-based assessment and effective classroom management techniques (D-2). ... D-4 stated that however do gaps of understandings and skills in practices such as tutorial classes because of shortage of time, weak understand through English as medium of instruction and lack of continuous simulation training... Moreover, D-1 stated that there were serious problems with respect to sizes of clinical sites and number of students it accommodates for practical trainings and willingness of hospitals' and clinics' professionals to support the would be health professionals' (IW-8, 27 March, 2021)

it is evidenced that assessment strategies were implemented (50% continuous assessment: 50% summative assessment) and there are problems of utilizing performance-based learning (PBL) and performance-based assessment (PBA). Furthermore, the discussants of FGD stated that

Table 8: Qualities of services of support staffs

Items	Instructors		Students		Sig (2-tailed) test	p-value
	M1	SD1	M2	SD2		
Up-to-date library digital	3.0	0.42	3.0	0.56	2.87	.55
Well-equipped skill-labs	2.88	0.57	2.6	0.59	1.72	.68747
Pedagogical center	2.57	0.82	2.5	0.53	0.98	.87158
Computers and internet services	2.88	0.45	2.5	0.57	1.86	.43542
Guidance and counseling services	2.75	0.59	2.5	0.56	2.15	.18725
Enough workshop (simulation) centers	2.97	0.48	2.8	0.47	1.46	.98785

Table 8 shows the average means of item 1 was rated the ideal average mean by instructors and students to address that there is up-to-date library. There is no a statistically significant difference between the views of respondents by the t-values at 2.87 is greater than alpha value ($p > .05$). On the other hand, the average mean values of items 2-6 were rated below the ideal mean (3.00) by instructors and students that underlined that there are no statistically significant differences between the views of respondents by the t-values at (1.71, .987, 1.86, 2.15 & 1.46) are greater than the alpha value ($p > .05$).

Additionally, one of the interviewees discussed that

I think the service of support staffs partially helps the teaching learning process although some limitations are vividly seen. I am sure that we have best library, laboratory and simulation centers computer and weak internet services. Attention was not given for pedagogical centers, guidance and counseling services' (IW-10, 25 March 2021)

...It was also evidenced from observation that the support staff services related to simulation, guidance and services, internet services and pedagogical services were partially seen although there are attempts to improve some services (Observation, March, 2021)

Table 9: Qualities and quantities of curricular materials

Items	Instructors		Students		Sig(2-tailed)	p-value
	M1	SD1	M2	SD2		
Competence based curriculum	3.23	0.53	3.62	0.32	2.80	.325
There are sufficient course guides	3.24	0.41	3.53	0.51	1.45	.747
Different audio-visual materials	3.23	0.39	3.24	0.31	1.89	.542
Up-to-date books	2.95	0.51	2.64	0.51	1.68	.544
Enough abstracts, journals	2.5	0.48	2.7	0.52	1.93	.917
Professional practical training	2.8	0.46	2.6	0.53	1.17	.899
Materials required quality standards	3.23	0.39	3.81	0.41	1.19	.780

Table 9 shows the average means of items 1, 2, 3, 8 & 9 were rated above the ideal mean by instructors and students. There are no statistically significant difference between the views of respondents by the t-values at (2.80, 1.45, 1.89, 1.19 & 2.56) are greater than alpha value $>$ 0.05. This shows that there are no significant differences between the opinions of the two categories of respondents. On the other hand, the average mean values of items 4, 5, 6 & 7 are rated below the ideal mean by instructors and students that there are no statistically significant differences between the views of respondents. Therefore, these are serious factors that affect students' learning, academic performance and achievement.

Moreover, one of the interviewees explained that currently, the quality and quantity of curricular materials (books, journals, syllabi, audio-visual and equipment) for health science are the focus of attention to improve the quality of would be health professionals. Therefore, as long as instructors carefully design and implement the teaching learning process, students will get curricular materials to the standards and indicators either in university or online' (IW5, 21 April, 2021).

....The document analysis finding shows that there are significant differences among students in their learning and academic performance across the department units. This indicates that students were evaluated differently according to their field of studies and capabilities. Therefore, the document analysis remarks that the majority of graduates lack the creativity and adaptability. They miss to bring originality, insight and superior critical and reflective abilities. Similarly, there were significant differences between male and female students' participation and academic performance across health science departments. The majority, 162 (46%) of students are at threshold level of performance (2.00-3.24) although students admitted to health science have relatively better admission points. However, 112 (32%) are at the modal level of performances (3.24-3.49) and 81 (22%) are top level of performances (3.50-4.00) respectively. Therefore, this document analysis remarks that the majority of graduates lack creativity and adaptability. They miss to bring originality, insight and superior critical and reflective abilities (Document Review, March 2021).

5 Discussion

The educational qualification of academic staff of the sample respondents is less than the required minimum standard set by /MoE/ETAE to give instruction at degree level i.e. at least 50% PhD, 50% M.A/M.Sc (Ministry of Education, 2018). This calls for inferior quality of education because teachers' professional development and educational qualification have paramount importance to promote quality of education. Similarly, the findings show that there are strong relationships between gender, family SES & education level, students' admission points, medium of instruction, previous high school, and

students' academic performances and achievements. Therefore, these are serious factors that affect students' academic performances and achievements. Although instructors' willingness and commitment to capacitate their students through different projects and conduct researches to rank students' academic performance, the participation of students in problem-based learning, motivation to learn from professional practices and projects were not convincing. Instructors' willingness and commitment to capacitate their students through different projects and attempts to improve their pedagogical knowledge through HDP training were not as such motivating. In addition, the study remarks that although management bodies' commitments to initiate academic staffs to conduct research projects & improvements of instructional processes to enhance students' academic performances were encouraging, their motivation and commitment to fulfill reading materials, computers and internet services were not encouraging. The competences (knowledge, skills or abilities) of students in light of academic background knowledge, subject matter knowledge and knowledge about the apparatuses and instruments and skills in the laboratory were not promising. Likewise, the abilities to undertake professional projects, language abilities to communicate and understand the subject matter and skills to transform theories into practice were not to the point to enhance health science students' learning and academic performance. Similarly, the opportunities to and qualities of educational inputs, the course materials to students' ratio, full time to part-time instructors' ratio and rooms for simulation training, instructor-to-students' ratio, computer-to-student ratio, lab technician-to-student ratio, instructors' qualification PhD/specialist: MSC/generalist and adequacy of clinical sites for apparent ship were below the required standards set by MoE. These are dynamic factors affecting teaching-learning process directly, and students' learning engagement, academic performance and achievement indirectly.

The findings of the study shows that there were strong efforts of instructors to cover curriculum contents in quantity and quality on time, demonstrate practical activities in clinical sites/lab skills and takes simulation training as educators of health care. However, the application of various active learning methods, performance based-assessment techniques, various classroom management techniques to check students' attendance, checking theoretical and practical understanding of students, giving technical supports, standardized and structural feedbacks to students were not satisfactory. The findings of the study mirrors out that the qualities support staff services are poor except that there is well equipped and up-to-date library. However, the study underlines that the presence of available and well-equipped skill-labs, support staffs for pedagogical center, sufficient number of computers and internet services, support staffs for guidance and counseling services and enough simulation centers were not encouraging. The accessibility of competence-based curriculum, different audio-visual materials, and quality standards of the curse materials, independent thinking and problem-solving are encouraging, the integration of theory and practice, up-to-date multiple copies of reference books, abstracts, journals and opportunities to participate in professional practical training were not convincing. However, the past and current assessment systems of HEIs show lack accurate understanding of graduates' competence, and relation with prior measures (Likisa, 2018).

The findings from document analysis and observation indicate that there were differences among students' academic performances across their department units. This indicates that students were evaluated differently according to their field of studies and capabilities regardless of the common criterion-referenced grading system. The Analysis shows that there were a statistically significant difference between males and females students' participation and academic performances across health science departments. The majority of students are at threshold level of performance even though students admitted to health science have relatively better admission points. However, some are at the modal level of performances and some are top level of performances. Therefore, this document analysis remarks that the majority of graduates lack creativity and adaptability. They miss

to bring originality, insight and superior critical and reflective abilities. although the lack of resources, large class size, shortage of instructional time, inadequate support, grade inflation, limited prediction power, lack of instructional materials, instructors' negative perception, lack of knowledge and skill in assessment, and large content of courses are the major factors for proper implementation and quality of assessment in HEIs (Moges, 2018; L. G. Wariyo and Kelbago, 2020).

6 Conclusions

The university teaching and learning process are scholarly activities and professions which draws high level performance and expertise in relevant professional experiences together with highly developed communication and interpersonal skills. The effectiveness of teaching-learning, research and innovation rendered academic staffs which participate in an integrated teaching-learning, research, innovative actions and community services to improve academic performance (M. Girma and Akliu, 2023). Although there were many attempts to enhance students' academic competences and performance, the in-campus, off-campus and other extraneous factors are affecting academic performance and achievement of undergraduate health science students in many multi-dimensions. The data collected through questionnaires and document analyses were organized, tabulated and analyzed quantitatively and those collected through interview, FGD and observation were narrated by mixing up with themes. Some demographic factors such as gender, family education level & SES, quality of previous high school, student's admission point and medium of instruction play significant roles in determining students' academic performance directly or indirectly. Furthermore, willingness, motivation, commitment and competences (knowledge, skills and abilities) of students themselves, instructors and management bodies with respect to enhancing academic performance and achievement were identified as crucial factors that affect learning and academic performances of students. Moreover, opportunities and qualities to educational inputs, educational process, services delivered by support staffs, quantities and qualities of curriculum materials were the most determinant factors affecting quality of learning, academic performance and achievement of undergraduate health science students.

7 Recommendations

Although the academic staff is high teaching experienced full-time workers and doing problem-solving research and disseminating research outputs, the qualifications of academic staffs unfavorably met minimum standard set by MoE. Therefore, it is imperative to recommend that improving chances of scholarship for academic staffs will in turn helps to improve health science students' learning, academic performance and achievement. For the improvement of students' learning engagement, academic performance and achievement, special mechanisms should be created to improve demographic characteristics of students such as gender, SES and educational level of the family, medium of instruction, quality of previous high school and students' admission points as they showed strong relationship with academic competences and performances. The study evidenced that the willingness and motivation shown by students to participate in problem-based learning, their motivation to learn from professional practices and projects, and their willingness and motivation to learn from reading materials were unfavorable. Hence, the CMHS management and administration bodies had better device research-based structural mechanisms on how to improve the willingness and motivation of students in order to make them top performing health professionals to solve the health problems of the society at large.

In addition, instructors' willingness and commitment to capacitate their students through different projects, to conduct researches to rank students' academic performances and to improve their classroom pedagogical skills through HDP training were not motivating. There should be an ongoing program of pedagogic training for instructors to enable them develop effective teaching and learning skills. It is essential to establish and strengthen well developed pedagogical center charged with developing pedagogical skills and supporting teaching of academic staff of CMHS to improve students' competences and performances. The management of CMHS had better improve their willingness, motivation and commitment of fulfilling reading materials, computers and internet services. The academic staff of CMHS should take the responsibility to design effective programs in producing competent professional practitioners/graduates who possess relevant discipline specific skills, abilities and general and adaptable knowledge base academic background on the subject matter and about the apparatuses and instruments of the skills laboratory, computer skills to grasp new information and interest to practice professional projects to improve undergraduate health students' learning, academic performance and competencies. Likely, students should better develop the culture of experiential learning and design strategies to improve their abilities to undertake professional projects, language abilities to communicate and understand the subject matter and skills to transform theories into practice were not to the point to enhance health science students' learning participation, academic performance and achievement.

The provision of adequate learning resources is an essential factor for both students and academic staff in the teaching and learning processes. So that CMHS administration should fulfill instructors to student ratio, computer to student ratio, lab-technician to student ratio, instructors' qualification PhD/specialist: MSC/generalist ratio, counseling and guidance services, pedagogical center services, computer and internet services, and availability of clinical sites for apparent ship through devising different strategies according to the minimum required standards set by MoE to improve academic performances of students. Therefore, the college had better have an on-going evaluation of its physical and technological resources in light of its vision, mission, current needs and plans of the future. The instructional process is the heart of quality of education & hence, administration, instructors and students should work hand-in-hand to improve students' academic performance and achievement. Accordingly: (i). Instructors should be advised to integrate theory and practice, and provide necessary opportunities to students that enable them to participate in professional practical training. (ii). Teaching staff of CMHS need to appreciate the principles of student-centered learning and the management bodies need to allocate budgets to invest on Introduction of modern equipment such as computerized presentation such as power point, modeling, videos & electronics performance system (EPS). (iii). Diversified learner-centered methods of teaching should be utilized more frequently by introducing pedagogical training to instructors, standardizing class size and the teaching loads of instructors. (iv). Teachers should provide students with opportunities to be involved in the structuring of their own learning experiences, encourage them to control of their own learning, develop their confidence by setting assignments which are challenging and relevance to the subject aims, providing constructive and timely feedback, develop students' analytical and critical thinking skills by providing different learning experiences to improve their academic performance and achievement. Finally, management bodies, instructors and students should work cooperatively and enthusiastically develop graduates at top level of performance with full creativity, originality adaptability, insight and superior critical and reflective abilities to solve health problems.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

Data Availability

Data can be made available on the behavior of the request

Declaration of interests' statement

The author declare no competing interests.

References

Al-Balushi, K. (2017). They feel that they have a voice and their voice is heard: Towards participatory forms of teachers' in oman.

Ali, N., et al. (2009). The factors influencing students' performance at university of technology mara kedah, malaysia. *Canadian Research & Development Center of Sciences and Cultures*, *3*(4), 326–337.

Amare, A. (2009). From knowledge acquisition to knowledge application: The case of curriculum inquiry in ethiopia. *Proceedings of the 1st International Conference on Educational Research for Development*, *1*(1), 411–445.

Amare, A., & Temechen, E. (2002). Education in ethiopia developmental perspective. *The Ethiopian Journal of Education*, *2*(2), 21–30.

Amin, H. (2005). Social science research: Conception, methodology and analysis. *Makerere University Press*.

Barnett, R. (1997). *Higher education: A critical business*. Open University Press.

Bloom, D. E., Canning, D., & Chan, K. (2005). *Higher education and economic development in africa*. World Bank.

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley; Sons.

Creswell, J. W. (2014). *Research design: Qualitative and mixed approaches* (4th ed.). Sage Publication.

Creswell, J. W., & David, C. J. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications, Inc.

Dills, A. K. (2006). Trends in the relationship between socioeconomic status and academic achievement.

Egert, F., Fukkink, R. G., & Eckhardt, A. G. (2018). Impact of in-service professional development programs for early childhood teachers on quality ratings and child outcomes: A meta-analysis. *Review of Educational Research*, *88*(3), 401–433.

Geiser, S., & Santelices, M. V. (2007). Validity of high-school grades in predicting student success beyond the freshman year. *Center for Studies in Higher Education*.

Girma, M., & Akliu, Y. (2023). Effectiveness of teaching-learning, research and innovative actions in hawassa university, ethiopia. *Cogent Education*, *10*(1), 1–21.

Girma, M. G. (2022). The effects of teachers' professional and pedagogical competencies on implementing cooperative learning and enhancing students' learning engagement and outcomes in science: Practices and changes. *Cogent Education*, *9*(1), 1–22.

Hansen, M. N., & Mastekaasa, A. (2006). Social origins and academic performance at university. *European Sociological Review*, *22*(3), 277–291.

Kipkebut, D. J. (2010). Organizational commitment and job satisfaction in higher education institutions.

Kolicic, I. (2006). Academic performance and scientific involvement of final year medical students coming from urban and rural backgrounds. *Rural and Remote Health*, *6*(2), 530.

Koul, L. (2008). *Methodology of educational research* (3rd ed.). Vikas Publishing Agency.

Kurt, S. (2020). Kolb's experiential learning theory and learning styles. *Educational Technology*.
Kweisga, F. (2002). School factors and academic performance.
Leu, E. (2000). *Quality of education: A review of the literature*. BESO Project.
Likisa, K. D. (2018). Challenges and prospects of competency-based education: The case of adama science and technology university alumni students and hawassa tvet college, adama, ethiopia. *The Journal of Competency-Based Education*, *3*(2), 129–141.
Mense, E. (2018). The impact of globalization and technology on higher education.
Ministry of Education. (2018). *Ethiopian education development roadmap: An integrated executive summary* (tech. rep.). MoE. Addis Ababa, Ethiopia.
Moges, B. (2018). The implementations and challenges of assessment practices for students' learning in public selected universities, ethiopia. *Universal Journal of Educational Research*, *6*(12), 2789–2806.
National Examination Agency. (2007). *National examination agency report* (tech. rep.). Ministry of Education. Addis Ababa.
Petousi, V., & Sifaki, E. (2020). Contextualizing harm in the framework of research misconduct: Findings from a discourse analysis of scientific publications. *International Journal of Sustainable Development*, *23*(3/4), 149–174.
Raychaudhuri, A., et al. (2010). Factors affecting student's academic performance: A case study in agartala municipal council area. *Bangladesh E-Journal of Sociology*, *7*(2), 52–69.
Rommel, L. (2004). On-the-job training of the bs information technology program of leyte normal university, tacloban city: An assessment. *International Journal of Education and Research*, *2*(3), 17–35.
Sentamu, N. P. (2003). Relationship between school environment and academic performance.
Shavelson, A. (1987). *Indicative system for monitoring mathematics and science education* (tech. rep.). RAND Corporation.
Sunshine, B. A., & Lawrence, C. (2015). Factors affecting the academic performance of the student nurses of bsu. *International Journal of Nursing Science*, *5*(2), 60–65.
UNESCO. (2019). *Beyond commitments: How countries implement sdg4* (tech. rep.). Global Education Monitoring Report. Paris, France.
United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development* (tech. rep.). UN.
Valli, J., & Santhi, B. (2014). Factors contributing to academic performance of students in a tertiary institution in singapore. *American Journal of Educational Research*, *2*(9), 752–758.
Wariyo, L., & Asgedom, A. (2021). Promoting effects of abilities while enhancing probability of college success: A moderation role of higher education. *Journal on Efficiency and Responsibility in Education and Science*, *14*(2), 101–117.
Wariyo, L. G., & Kelbago, R. A. (2020). Applying grade inflation adjustment mechanism in an ethiopian university: Differences in nominal and real grades.
Waters, T. J., & Marzano, R. J. (2006). *School district leadership that works: The effect of superintendent leadership on student achievement*. Mid-continent Research for Education; Learning.

Ethiopian Journal of Education Studies
OPEN ACCESS
ISSN(online): 27892875
Web link: https://journals.hu.edu.et/hu-journals/index.php/eies/

Original Article

The role of self-leadership strategies in coping with stress level of freshmen students entered in 2020 at Hawassa University

Gelan Gaguray [1*], Woma Gabiso [2] and Abenet Wondimu [3]

[1,2,3] Educational Leadership and Management and College of Education, Hawassa University

ARTICLE INFO

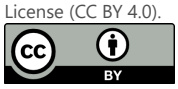
Volume I, Issue I (2023)
https://doi.org/10.20372/8kvasz59

CORRESPONDING EMAIL
* Corresponding author email: gelang@hu.edu.et

ARTICLE HISTORY
Submitted: 11 Feb, 2023
Accepted: 15 Jul, 2023
Published Online: 31 Jul, 2023

CITATION
Gaguray, G., Gabiso, W. and Wondimu, A. (2023). The role of self-leadership strategies in coping with stress level of freshmen students entered in 2020 at Hawassa University. *Ethiopian Journal of Education Studies*. Volume I, Issue I (2023), 33-52. https://doi.org/10.20372/8kvasz59.

OPEN ACCESS
This work is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).



KEYWORDS:
Coping skills;
self-leadership;
self-leadership strategies;
stress

Abstract

This research scrutinizes the role of self-leadership strategies in coping with stress among freshmen students entered in the 2020 entry at Hawassa University. To achieve the objective, convergent parallel design (QUAN+QUAL) and mixed-methods were employed with pragmatism research paradigms perspectives. Consequently, 362 students from the natural and social science streams were selected by simple random sampling techniques, and 8 lecturers, 12 student class representatives, and 4 counseling office members were taken by purposive sampling techniques. The data was collected through questionnaires, semi-structured interviews, and FGD. The analyses of the data were conducted by applying both descriptive statistics and inferential statistics including person correlation and linear regression and qualitative data by using a thematic analysis approach was employed. The results revealed that there was a high level of academic stress, a moderate level of psychological, social, and environmental stress, and a low level of physiological stress among the students. Besides, the students do not effectively practice self-leadership strategies. The relation between self-leadership strategies and stress positively correlated and as a significant predictor of stress is behavior focused strategies were found to have the strongest effect on coping stress followed by other strategies. Thus, if freshmen do not use adequate stress-coping techniques to deal with a negative stressful event, their stress can linger over time, increasing their chance of having serious academic, social, psychological, and environmental difficulties. Thus, structured and integrated self-leadership training is given to students in a continuous and systematic manner, orienting and supporting them through their academic tenure at their institutions and providing freshman-oriented counseling services by counselors through psycho-education approaches to strengthen the habits of self-leadership culture in coping with stress. Moreover, students should construct an effective time management program for studying and pleasure activities during their study years to enhance learning outcomes.

1 Introduction

Self-leadership is a process of behavioral and cognitive self-evaluation and self-influence whereby people achieve the self-direction and self-motivation needed to shape their behaviors in positive ways in order to enhance their overall performance. More precisely, self-leadership involves specific sets of strategies and normative prescriptions designed

to enhance individual performance (Neck and Houghton, 2006; Neck and Manz, 2010). Self-leadership is the process by which a person controls his/her own behaviors, creates influence and leads oneself using specific behavioral and cognitive strategies (Manz, 1986, Manz, 2015; Manz and Neck, 2004; Manz and Sims, 2001). From the above definition, it can be conclude that, self-leadership is an enabling process where by a person learns to know him/herself better and through this better self-understanding is able to steer his/her life better. Thus, self-leadership offers the opportunity for students to take responsibility for themselves and the notion that one can be responsible for leading oneself through life is exciting, especially in University's life.

However, one of the greatest challenges University students face in leading themselves is the effective management of stress. Stress is a situation where environmental demands exceed the capacity for effective response by the individual and can potentially have physical and psychological consequences (Rout and Rout, 1993). College students undergo numerous educational, social, environmental and psychological adjustment difficulties in the new campus atmosphere which may affect their psychosocial well-being and learning outcomes. These happen because the new tertiary educational system has a big difference in its methods of teaching, academic requirements, type of relations between faculties and even relations among students themselves (Thawabieh and Qaisy, 2012).

In short, stress seems to be very common in college students' life because college students need to ensure their academic survival and prepare themselves for the further career. It is not a surprise that much of the academic stress at the college level is associated with what students learn and how they learn it. Therefore, if University students fail to employ effective stress coping mechanisms to handle the negative stressful situation, their feeling of stress can persist over time and, in turn, become at a higher risk of developing severe physical and mental problems (Auerbach and Gramling, 1998). Coping can be described as the ability with which one handles a stressful event (Walton, 2002a and Misra and McKean, 2000). In response, some researchers have suggested that self-leadership has the potential to reduce stress and enhance coping (Kariv and Heiman, 2005).

According to Manz and Neck, self-leadership strategies are grouped into three primary categories (Neck and Manz, 2007). 1) Self-leadership's behavior-focused strategies include self-observation, self-goal setting, self-reward, and self-correcting feedback (Mahoney and Arnkoff, 1978, 1979; Manz and Sims, 1980). 2) Natural reward strategies focus on learning to see the naturally rewarding aspects of work and trying to implement to work aspects that are naturally rewarding (Deci and Ryan, 1985; Neck and Houghton, 2006; Mahoney and Arnkoff, 1978, 1979). 3) Constructive thought pattern strategies include positive self-talk, beliefs and positive mental imagery. The strategies are meant to reframe one's mind and to create more positive and constructive ways of thinking (Neck and Houghton, 2006; Neck and Manz, 1992, 1996). Thus, the purpose of the current study is to examine the role of self-leadership strategies in coping with stress among freshmen in 2012 entry at Hawassa University.

2 Research Problem

While time spent at University is a fond memory and a happy experience for most. University life is not without its rough patches. Every student's situation is unique, but there are a few problems that almost all University students deal with at least once during their time at college. These happen because the new tertiary educational system has a big difference in its methods of teaching, academic requirements, type of relations between faculties and even relations among students themselves (Thawabieh and Qaisy, 2012).

The transition of students from high school to the college environment is very much stressful for students. It could cause psychological, academic and social shock to them. Despite this fact, stress, depression and anxiety are prevailing mental health problems among college students (Kitzrow, 2003 & Sofyan et al., 2018). Colleges and universities across the nation are facing stress with no regard to their age, gender, educational status or socioeconomic status.

Therefore, in this situation, if students fail to cope with such demands, stress may lead to anxiety, drinking problems, depression and a multitude of other mental health problems. Raised stress levels amongst students can go beyond the decline in their academic accomplishments and can affect both the physical and mental health of students. All these causes can be eased with adequate adaptation of self-leadership methods, because it helps to recognize priorities and decreases inefficient time management.

Scott (2009) has also attested that college students are bare to the extensive amount of stress, which necessitates successfully and constantly changing coping strategy. To cope it, practicing self-leadership can have remarkable positive effects and significantly increase their self-efficacy and self-esteem and help maintaining balance in less fortunate times. Therefore, it deserves more attention.

Self-leadership has a primary effect which has a relation to all other areas of life (Myöhänen, 2010) and (Kurikka, 2010). However, students at higher institutions are not even aware of the existence of the actual concept self-leadership. Oneself is the most difficult person to lead and if one cannot lead oneself it is not easy to lead his/her life. Many situations will arise which will cause conflicts if own mind cannot be controlled. Succeeding in self-leadership regulates the balance of own mind and after that it is easy to lead life. Even though a wide range of studies have conducted on stress among students, the findings are self-contradictory and mixed up (Agolla, 2009). Self-leadership is a relatively new approach in leadership. There is no cross-scientific unified theory of self-leadership and also little scientific research has been done on individual change. Despite the lack of scientific background self-leadership is often the starting point of all leadership training nowadays. It will receive more scientific attention in the future (Sydänmaanlakka, 2005). More importantly, there was a significant paucity of empirical studies on the self-leadership practices and stress management in the Ethiopian context in general and Hawassa University in particular.

To address such research gaps, the present study took an initiation to explore the role of self-leadership on reducing students' levels of stress. The study is believed to theoretically contribute to the body of scientific knowledge on contribution of self-leadership on reducing stress and enhancing college student's academic achievement. Practically, the study may guide college communities to take concrete steps towards the improvement of the learning environment and subsequently mitigating the adverse impact of stress on students' wellbeing and learning outcomes. Based on the theoretical and empirical bases reviewed above, researcher advances the following research questions:

1. To what extent do the sources of stress contribute to the level of stress among freshmen?
2. To what extent are self-leadership strategies practiced by freshmen to cope with stress?
3. To what extent do the self-leadership strategies influence on reducing stress levels among freshmen?

2.1 Objectives

The general objective of this study is to examine the role of self-leadership strategies in coping with stress among freshmen students entered in the 2020 entry at Hawassa University. The study helps to:

1. Identify the sources of stress contribute to the level of stress among freshmen?
2. Examine the culture of self-leadership practices among freshmen?
3. Examine the extent of self-leadership strategies influence on coping stress among freshmen?

2.2 Significance

It is thought that the findings of this study have the following significance:

1. Provides an excellent framework for stress reduction that may be emulated across multiple disciplines in higher education resulting in higher levels of student well-being and personal effectiveness.
2. It could play a role in assisting the instructors and the student representatives to provide the necessary support and follow-up for the implementation of guidance and counseling services.
3. The findings of this study may helpful to the educationists, educational planners and policy makers, teachers and students to makes strategy to overcome the problems of students, who are displaying the aggressive behavior.
4. The research findings may encourage and inspire other researchers to conduct associated studies and to explore related concerns to solve interrelated problems.

3 Literature Review

3.1 Concept of self-leadership and stress

Self-leadership is a relatively new approach in leadership. There is no cross-scientific unified theory/definition of self-leadership. Thus, different scholars define self-leadership in different way. Among, Neck and Manz (2007) defined it as the process of influencing oneself more specifically to establish the self-direction and self-motivation needed to perform a task. Furthermore, **freeman2004<empty citation>** defines self-leadership besides having self-discipline as a "set of well-defined strategies for personal improvement". Fundamentally self-leadership has three elements: sufficient self-confidence, good self-knowledge and the ability to reflect (Sydänmaanlakka, 2005). It is a life-long process in which one can learn to lead bigger entities starting from leading himself and proceeding step by step towards bigger teams (Sydänmaanlakka, 2006). From this one can deduce that with self-leadership one learns to know oneself better and is able to control own life better through improved self-understanding. In short, it is a self-executed process.

According to Lazarus and Folkman (1984), stress is defined as an individual's physical and psychological reaction to an event or object or which is appraised as a threat. Similarly, according to **campbell2006<empty citation>** as cited in Bataineh (2013), stress is an adverse reaction that individuals manifest when they encounter excessive pressure or other types of demands placed on them. Stress especially arises when individuals are

under overwhelming situation and believe that they are incompetent to handle. The definitions reflect that stress is psychophysical phenomena which come into existence as a result of a continuous interaction between the individual and the environment.

3.2 Sources of stress

With respect to the levels of stress and stressors, previous literature has invariably documented that college students are exposed to different kinds of stressors and stress level. Abouserie (1994) as cited in Misra and Castillo (2004) reported that students experience academic stress at foreseeable times each semester with the highest causes of academic stress resulting from taking and preparing for exams, grade competition, and a large amount of content to master in a small amount of time. Additionally, in concord to our finding, a Bataineh (2013) reported that college students are more stressed with financial problems, inadequate resources like computers, books, lecturers, and overload hours every semester as academic stressors. Environmental related stressors are also pronounced. For example, in a study conducted in Ghana, environmental factors were found to be the source of high level of stress among students (Azila-Gbettor et al., 2015). It is not a surprise to observe college students in developing countries experiencing a higher level of stress associated with the low-quality learning environment. About the physiological component of stress, previous studies such as Walton (2002b) reported that college students with poor health habits like poor diet, lack of exercise, and inconsistent sleep patterns inflict high-stress levels. Thawabieh and Qaisy (2012) found that university students experienced stress related with the social factor, and this may be because students come from different cities and they have new relations. However, Feng (1992) stated that setting high standard goals, being perfectionist, comparing self with others and self-degradation might be sources of student's psychological stress.

3.3 Self-leadership strategies

An essential self-leadership theorist Charles C. Manz created one commonly recognized theory together with Christopher P. Neck. According to Manz and Neck, self-leadership strategies are grouped into three primary categories: 1) Behavior-focused strategies include self-evaluation, self-discipline and self-rewarding. The strategies are meant to encourage having long-term goals and desirable behaviors that lead to successful results and discourage undesirable behaviors that lead to unsuccessful results. 2) Natural reward strategies focus on learning to see the naturally rewarding aspects of work and trying to implement to work aspects that are naturally rewarding. The idea is to learn to make work feel as naturally rewarding as possible and get energized from the work itself. This leads to productive behavior and good performance. 3) Constructive thought pattern strategies include positive self-talk, beliefs and positive mental imagery. The strategies are meant to reframe one's mind and to create more positive and constructive ways of thinking (Neck and Manz, 2007).

3.4 Relationship between self-Leadership strategies and stress

Individuals can cope with stressful situations and hinder the formation of stressful situations through the effective self-leadership of their behaviors, and thus, they can increase their life satisfaction. It is suggested that behavior focused strategies lead to successful outcomes by encouraging positive, desirable response and by suppressing undesirable behavioral response tendencies (Neck and Houghton, 2006). Achieving desired results may lead to a positive outlook towards oneself, life, future and positive affect. On the

other hand, the idea that constructive thought strategies increase subjective well-being (Houghton and Jinkerson, 2007) was supported in this study. Constructive thought strategies have been said to serve satisfaction by functioning as a source for the development of positive thought (Manz, 1992).

3.5 Conceptual framework

The conceptual framework for this study was a comprehensive self-leadership framework (modified from Neck and Manz, 2007). From the below figure, one can see how everything in self-leadership connects. On the left side are self-leadership categories with their sub categories by **manz2007mastering<empty citation>** besides time management. Using these tools adequately leads to the congruency of body and mind, where physical and mental balances align and create intelligent, motivated, and purposeful thinking and behavior. This empowering congruency is self-lead to three projects of personal development in chosen areas of total wellness by Sydänmaanlakka (2006). The commitment in the projects leads to personal effectiveness and successful performances, which creates positive perceptions of self-efficacy leading to more personal effectiveness, which becomes an upward spiral leading to more successful performances as shown in Fig.1 below:.

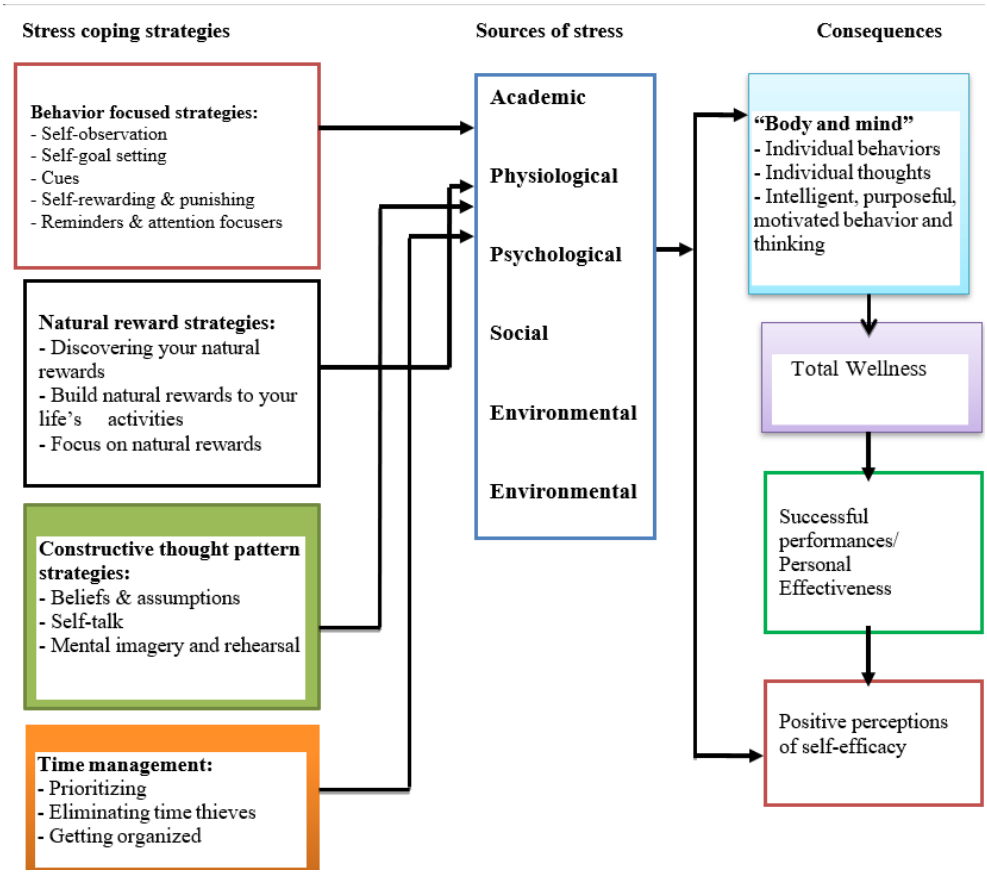


Figure 1: Comprehensive self-leadership framework (modified from Neck&Marz 2007,129,171)

4 Research Design

In order to collect, analysis, interpret and report the data scientifically this study was employed concurrent mixed method research design with equal priority of both quantitative and qualitative method (QUAN+QUAL) with philosophical view of pragmatism. This paradigm did not arise among philosophers who argued that it was not possible to access the 'truth' about the real world solely by virtue of a single scientific method. Supporters of this paradigm looked for approaches to research that could be more practical and pluralistic approaches that could allow a combination of methods that in conjunction could shed light on the actual behavior of participants, the beliefs that stand behind those behaviors and the consequences that are likely to follow from different behaviors. This paradigm was chosen since it advocates a relational epistemology (i.e. relationships in research are best determined by what the researcher deems appropriate to that particular study), a non-singular reality ontology (that there is no single reality and all individuals have their own and unique interpretations of reality), a mixed methods methodology (a combination of quantitative and qualitative research methods), and a value-laden axiology-conducting research that benefits people (Alise and Teddlie, 2010; Biesta, 2010; Tashakkori and Teddlie, 2003, and 2003b; Patton, 1990). Thus, the result was interpreted by giving equal priority for both quantitative and qualitative findings by triangulation.

4.1 Sources of Data

For the purpose of this study both primary and secondary sources of data was used. The primary sources were students, lecturers, guiding and counseling experts and students' representatives of selected faculty from respective departments. The students' semester result was taken as secondary data of sources.

4.2 Sample and Sampling Techniques

The target population of the study was 2012 entry students at Hawassa University. The subject on which these research activities are to be carried out includes students and lecturers. To make the study manageable and due to the homogeneity nature of the participants, from social science faculty 15 groups and 15 groups from natural science faculty were taken by quota sampling, while from each group, 12 students were selected by simple random sampling (lottery method). To obtain the representative sample size of students from selected groups, a simplified formula developed by Krejcie and Morgan (1970) is used as cited in Deribsa (2017). Because, this formula has been practically tested and used by various scholars for past years and it is valid useful up to now in educational research. Then, the representative sample size can be calculated as follows;

Questionnaire, interview and Discussion (FGD) were used to gather relevant data.

Where:

n = sample size of respondents participated in study

Z^2 = Chi-square for the specified confidence level (1.96 at 95% confidence interval), N = population size (5260), P = population proportion (0.5 in this study case), ME = acceptable margin of error 5% (0.05)

$$Thus, n = \frac{Z^2 * N * P(1-P)}{(MEii2 * (N-1)) + (Z^2 * P * (1-P))i}$$

$$n = \frac{1.96^2 * 5260 * 0.5(1-0.5)}{(0.05i2 * (5260-1)) + (1.96^2 * 0.5 * (1-0.5))}$$

$$n = \frac{5,762.4}{14.9975 + 0.9604}$$

$$n = \frac{5,762.4}{15.9579}$$

Hence, the sample size is equal to 362 selected. Moreover, 8 instructors from psychology department, 4 guiding and counseling experts from Hawassa University guiding and counseling offices and 12 student's representatives were taken by purposive sampling techniques.

4.3 Data gathering tools

4.3.1 Questionnaires

A questionnaire with both closed and open-ended items was used to collect quantitative and qualitative data from selected groups of both natural and social science students concurrently. In this case, self-made questionnaire was developed by English language and distributed to students. All investigation questions employed a Likert type scale response. Furthermore, the open-ended questions were included in the questionnaire in order to give an opportunity for respondents to express their view, feelings and perceptions related to self-leadership practices, sources of stress and coping strategies.

4.3.2 Interview

A semi-structure interview item prepared as an instrument of data collection from instructors guidance and counseling experts and conducted in English language with instructors. The purpose of selecting such type interview is because of its flexibility and could be restructured on any defects observed on questions (Abiyi et al., 2009). Because, the researcher believed that they had sufficient understanding about the extent to which students were effective in practicing self-leadership, understanding sources of stress, using coping strategies and solving the challenges they face.

4.3.3 Focus group discussion

with student's representatives of a class to find out what might be a reason for stress and to take the advantage of collecting variety of shared understanding from these interacting students. They were taken because of they have better understanding on

self-leadership, sources of stress and coping strategies. This can helped the researcher to understand the situation from the facial expression of the participants in addition to questionnaire. The researchers grouped the respondents in to 3 to get clear and in depth information and the discussion sessions were conducted in both English and Amharic for 1 hour per group in order to maximize student's participation and subsequently the data was translated in to English language. Then, the FGD result finally narrated based on the following given symbol (Group-1), (Group -2), and (Group-3). Finally, the obtained information from the focused grouped discussion was triangulated with the quantitative data.

4.4 Procedures of data collection

Before, the actual data collection task was took place, the researcher was first prepared questionnaires based on objective and basic research questions of the study. After questionnaires was prepared and submitted to senior department instructors to check the relevance of it. Based on the comments given by those instructors, necessary correction was made and duplication of the questionnaire was done considering the sample sizes of each group of the respondents. The researchers have contacted each department heads and making agreement on the concerned political issues after introducing the objectives and purposes of the study. Then, the final questionnaires were administered to sampled students. The participants were allowed to give their own answers to each item independently. Furthermore, the interview and FGD session was administered. Finally, the data collected was analyzed and interpreted based on basic questions.

4.5 Methods of data analysis

Both quantitative and qualitative data analysis techniques were used, depending on the type of data gathered and the instrument used. In addition to this, the data analyses were made using the Software Package for Social Science /SPSS/ program version-26 for quantitative data. Then percentage, cross tabulation, individual mean scores, average mean score and standard deviation was used to address the basic questions while independent sample t-test was employed to check whether there is a significant difference between students of natural and Social science rating (Cohen et al., 2007; James, 1982; Ravid, 2011). According to Arcağok and Yılmaz (2020), cited in Eshetu (2017), the mean value was interpreted as 5-4.21-mean score "Very High"; 3.41-4.20 "High"; 2.61-3.4 "Moderate"; 1.81-2.60 "low"; and 1.00-1.80 "Very low". Arcağok and Yılmaz (2020). In identifying the level of significance alpha level $p \leq 0.05$ was used (Burke and Larry, 2008; Ravid, 2011; Weirsma and Jurs, 2009). Person correlation coefficient was also used to analyze strengthens and magnitude of the self-leadership practices and stress level. In addition linear regression was used to predict the value of self-leadership strategies on the level of stress among freshmen. Creswell's qualitative narrative writing techniques were used in the analysis of the qualitative data. Finally, quantitative and qualitative data triangulated and results were reported.

5 Results

This part of the research deals with the results and discussion of the data obtained through questionnaire and review of literatures. The survey questionnaire was distributed to total of 362 students and 346 filled and returned mean that 95.6%. The data were analyzed by employing mean, standard deviation, correlation and linear regression.

Table 1: Demographic Characteristics of Respondents (N = 346)

Items	Variables	
Sex	Male	154
	Female	192
Age	19-24	343
	25-30	3
Marital Status	Single	339
	Married	7
Field of the Study	N science	179
	S science	167
Family Information	Both Mother & Father	233
	Single Parent	76
	Divorced family	37
Family economic status	High income	30
	Low income	187
	Moderate income	129

Table 1 shows that to obtain socio-demographic information of the students, questions related to their sex, age, marital status, family information, and family economic status along with field of the study were provided was explained on above table.

5.1 Sources of Stress

The transition of students from high school level to the college level is inherently stressful for students. From this perspective, academic, psychological, physiological, social and environmental related stress presented and analyzed below.

Table 2: Perceptions of respondents on sources of stress

Sources of Stress	Respondents	Mean		Aggregate		
		N	SD	Mean	SD	df
Academic stress	NS	179	3.53	3.48	0.53	344
	SS	167	3.43	0.55		
Physiological stress	NS	179	2.56	2.57	0.55	344
	SS	167	2.58	0.56		
Psychological stress	NS	179	3.24	3.23	0.78	344
	SS	167	3.22	0.79		
Social stress	NS	179	3.20	3.20	0.88	344
	SS	167	3.20	0.92		
Environmental stress	NS	179	3.14	3.18	0.80	344
	SS	167	3.23	0.82		

Note: NS, natural science; SS, social science; df, degree of freedom

Table 2 shows that both groups of respondents rated high academic stress (3.48) and low-level physiological stress (2.57) as high, while psychological (3.23), social (3.20) and environmental (3.18) related stresses were moderate. An independent sample t-test was computed to decide whether the perceptions of the respondents differed between the two groups of respondents. Thus, it is understandable that students face stress levels in each category feel differently.

5.2 Self-leadership's strategies in coping stress

Self-leadership tactics such as behavior-focused strategies, natural reward strategies, constructive thinking pattern strategies, and time management practices of freshmen are described in this section.

Table 3: Respondents' perspectives on the practices of self-leadership strategies

Sources of Stress	Respondents	Aggregate			
		N	Mean	SD	Mean
Self-Leadership's Behavior-Focused Strategies (SLBFS)	NS	179	2.12	0.58	2.20
	SS	167	2.30	0.61	
Natural Reward Strategies (NRS)	NS	179	2.05	0.86	2.03
	SS	167	2.03	0.90	
Constructive Thought Pattern Strategies (CTPS)	NS	179	2.19	0.95	2.10
	SS	167	2.02	0.93	
Time Management (TM)	NS	179	2.20	1.00	2.22
	SS	167	2.25	0.93	

According to Table 3, both groups of respondents rated self-behavior-focused leadership's strategies (2.20), natural reward strategies (2.03), constructive thought pattern strategies (2.10), and time management strategies (2.22). An independent sample t-test was used to determine whether respondents' perceptions differed between the two groups of respondents. As a result, it is understandable that students have a minimal culture of practicing self-leadership strategies in coping strategies.

5.3 Correlations between self-leadership strategies and stress

The correlations between the university freshmen self-leadership strategies (behavior-focused, natural reward, constructive thought, and time management strategies) in coping with stress were discussed in this section using Pearson correlation analysis.

Table 4: Correlations of self-leadership strategies and stress

Correlations						
		SL	SLBFS	NRS	CTPS	TM
SL	Pearson Correlation	1	.846**	.708**	.936**	.808**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	346	346	346	346	346
SLBFS	Pearson Correlation	.841	1	.759**	.727**	.866**
	Sig. (2-tailed)	.000		.000	.000	.000
	N	346	346	346	346	346
NRS	Pearson Correlation	.708**	.769**	1	.895**	.849**
	Sig. (2-tailed)	.000	.000		.000	.000
	N	346	346	346	346	346
CTPS	Pearson Correlation	.936**	.737**	.797**	1	.806**
	Sig. (2-tailed)	.000	.000	.000		.000
	N	346	346	346	346	346
TM	Pearson Correlation	.908**	.856**	.748**	.809**	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	346	346	346	346	346

**Correlation is significant at the 0.01 level (2-tailed).

Note: SL-Stress Level; SLBFS-Self-Leadership's Behavior-Focused Strategies; NRS-Natural Reward Strategies; CTPS-Constructive Thought Pattern Strategies and TM-Time Management.

As we can observe from correlations table, stress has strong positive relationship with all self-leadership strategies presented. Furthermore, correlations of stress in SLBFS explained by r = 0.846, $r^2 = 0.7157$ or 71.57% with p = 0.000 $<$ 0.01. This shows us the significant positive relationship or association between stress and SLBFS in which the maximization of one can result the increasing on another. Besides stress in NRS presented as r = 0.708, $r^2 = 0.5012$ or 50.12% at p = 0.000 $<$ 0.01 assures us the significant positive association between stress and NRS. The r = .936, $r^2 = 0.8760$ or 87.60% at p = 0.000 $<$ 0.01 showed the significant positive relationship between stress and CTPS. Furthermore, r = 0.908, $r^2 = 0.8244$ or 82.44% at p = 0.000 $<$ 0.01 explains significant positive relationship between stress and TM.

Hence, the relationship between dependent and independent variables (stress & self-leadership) is significant at p = 0.01. And also the independent variables showed the positive relationship between each other and their relationship is significant at p = 0.01. Now we can proceed to developing the regression equation to predict the magnitude of the influence of each variable on the level of stress. Let us see the SPSS outputs and its result analyzed here below.

Table 5: Model summary of self-leadership strategies and stress level

Model Summary					
Model	R	R^2	Adj R^2	Std. Error	Durbin-Watson
1	.858a	.871	.876	.16135	1.321
a. Predictors: (Constant), SL, SLBFS, NRS, CTPS and TM					
b. Dependent Variable: Stress Level					

Table 6: Test of model summary of self-leadership strategies and stress level

ANOVA					
Model	Sum of Squares	df	Mean Square	F-value	Sig.
1 Regression	19.546	3	4.886	270.320	.000b
Residual	.581	342	.023		
Total	20.271	345			
a. Predictors: (Constant), SLBFS, NRS, CTPS and TM					
b. Dependent Variable: Stress Level					

Table 7: Coefficients of self-leadership strategies and stress level

Model	Unstandardized β	Std. Error	Standardized β	t	Sig.	95% CI	
(Constant)	-1.13	.247		-3.61	0.00	-1.67	-0.65
SLBFS	0.49	.063	0.48	6.12	0.00	0.25	0.46
NRS	0.53	.241	0.26	2.37	0.01	0.10	1.12
CTPS	0.44	.086	0.27	3.31	0.001	0.12	0.53
TM	0.04	.106	0.04	0.38	0.69	-0.17	0.25

β, Unstandardized Coefficients β Standardized coefficient; LL, lower limit; UL, upper limit; CI, confidence interval

In table 7 of correlation we obtained the contribution or the relationship of each independent variable with dependent one. Now to develop regression equation and to predict the influences of each variable, we should find out the jointly contribution of the independent variables on the job satisfaction. To this end, R = 0.858, $r^2 = 0.7361$ or 73.61% shows the strong relationship and 73.61% amount of stress is explained by SLBFS, NRS, CTPS and TM collectively. The Durban-Watson = 1.321 found at between 1 and 3 which implies the errors are uncorrelated. Besides, the appropriateness of the regression model, the values F test = 20.271 and p = 0.000 $<$ 0.05 denotes that, the regression model developed to estimate the stress level based on SLBFS, NRS, CTPS and TM is good and strong. And also it can judge the model goodness looking at the values of tolerance and VIF. The VIF values of all independent variables lie between 1 and 10; and Tolerance values also found between 0.1 and 1. Therefore, the estimate of stress level based on SLBFS, NRS, CTPS and TM indicate no serious the level of multicollinearity despite of fact that the independent variable. To conclude, among the self-leadership practices were investigated self-leadership's behavior-focused strategies, natural reward strategies, constructive thought pattern strategies and time management as influential variables on freshmen stress level. Moreover, self-leadership's behavior-focused strategies the most influential strategies to cope stress among freshmen of specific entry of Hawassa University.

5.4 Findings from FGD and interview sessions

Focus group participants were 12 and grouped under three, and each group consisted of four members represented by G1, G2, and G3. Each group discussed the guiding questions for one hour with one student from the group who acted as moderator and discussed major sources of stress, the practices of self-leadership strategies and coping mechanisms in line with the guiding questions. The result found that the possible sources of stress among freshmen were the newness of the environment (the university life) and the worry about how to adapt to a new learning process (independent learning technique) because the teaching-learning process and the way of life in the dormitory and the community they were living in were quite different from what they knew before (G1). In addition, a number of false statements from their alumni and senior students about the hard and unclear assessment and grading system (G2) and the strict law of the university (G3). They also came to a common agreement that the activities, assignments, and final exams came together at the end of the semester, and that made them think over to completion which of those activities they had chosen. It also made them confused about their work.

G3Q2 Monday 4:00; the discussion leading question was forwarded by a moderator and the group started the discussion, among the members said that

"higher elements for my frustration on the university stay were studying for long hours like attending class morning and afternoon, doing individual as well as group assignments every day, and I was also too busy to prepare for the mid and final exam." (G3Q2 Monday 4:00).

G2Q2 Other FDG group members also responded about prevalent stress. Student Y said that "I was confused by the instructors' teaching style because they did not give a note on board what I knew in high school but they described the lesson orally and gave us reading material." In addition to that, participant Z forwarded that "when I think about university stay and study pressure, I did not sleep and became stressed. That made me becomes unstable."

As discussed during the interview session, the new education policy being implemented on their batch causes stress, as does the manner of exam administration and the number

of invigilators and supervisors (12,3,8). In addition, I4,5,7 explained that the political situation of the country and the alarming rate of death in other countries, including Ethiopia due to COVID-19, can be a source of stress.

In addition to this, the interview conducted with instructors from (11:30) expressed the academic stress conditions as follows:

...the students' academic background (lower, medium, and higher achievers), the culture of the new institution, and previous ways of life with their family, and their expectations and experiences of entering university and simply listening to others speaking on the social media, especially on FB, without triangulating it with the situation and their goal are sources of stress.

The guidance and counseling expert of HU discussed that;

...among the sources of stress for undergraduate students' were wasting time on using Face-Book (FB), sexual preference due to freedom from the influence of their family, unwanted pregnancy, low scores in exams, and simply listening to others speaking on the media, especially on FB, without triangulating their goal. He also stated that self-leadership practice is not cultured and even though it is a new concept to freshmen students, their lives depended on their families before they joined university (GCE1 and 2).

6 Discussion

6.1 Sources of stress and its level

The research determined the general level of stress of the students as a result of the five components of stress taken in the present study. The extent of stress level was high in academic, low in physiological and; moderate in psychological, social and environmental stated in table 1. Therefore, academic stress was causing factors and needs effective self-leadership strategies of the students. This finding is similar to Yikealo et al. (2018) academic stressors have been found to contribute to the level of stress of the students. Pressure in daily studying, difficult to deal with academic problems, depression due to low CGPA, difficulty in studying for long hours, dissatisfaction with one's program and boringness in attending classes regularly were reported to be the most academic stress causing factors among freshman students of Hawassa University. Parallel to this finding, Abouserie (1994) as cited in Misra and Castillo (2004) reported that students experience academic stress at foreseeable times each semester with the highest causes of academic stress resulting from taking and preparing for exams, grade competition, and a large amount of content to master in a small amount of time. Apart from this, they do not bother too much about unfair grading system. Generally, academic stress was at high level prevalent among freshman students of Hawassa University of the particular entry year. Therefore, academic stress was causing factors and needs effective self-leadership strategies of the students to cope stress.

But, respect to physiological stress overall mean 2.57 falls at low level which indicates that issues rose under physiological stressor rarely perceived as source of stress. Related study indicated that tiresomeness contributes most to a high level of stress which is high in comparison with a daily headache, breathing problem, increased heartbeat, and poor appetite (Yikealo et al., 2018). And also, about the physiological component of stress, previous studies such as Walton (2002b) reported that college students with poor health habits like poor diet, lack of exercise, and inconsistent sleep patterns inflict high-stress levels. In contrary to these findings, the majority of the participants reported a lower level

of stress as a result of various physiological problems. The low level of physiological stress in sample might be due to the students might not have any physical health problems that can be sources of stress. Therefore, it is concluded that, as a result of physiological stressors, the stress level of freshman of Hawassa University is low in particular entry year.

The calculated mean values (ranging from 3.18 to 3.23) show that rest, psychological, social, and environmental stress all have a moderately negative impact on stress levels. This indicates that these stressors have the power to negatively influence the success of students unless well managed and with ample information. Therefore, it is deduced that the lack of good relationships with others, conflict with others, lack of electricity rarely causes stress on their reading and studying, lack of a well-equipped dormitory, difficulty in computer and internet access, discomfort with the quality of the classroom settings, being unable to enjoy the institution's cafeteria service, water supply problems, quality health service, terrible problems in latrine, shower service, and disappointment due to the inadequate study rooms moderately cause stress on the freshman students of Hawassa University.

From the interview and FGD, the policy being implemented on their batch, the culture of exam examination and scoring low, the political situation of the country and the alarming rate of death in other countries, including Ethiopia due to COVID-19, the students' academic background (lower, medium, and higher achievers), their new environment, and previous ways of life with their family, and their expectations and experiences of entering university and simply listening to others speaking on the social media, especially on FB, without triangulating it with the situation and their goal are sources of stress.

6.2 The practices self-leadership strategies to cope stress

Self-leadership consists of several strategies. These strategies are named behavior-focused strategies, constructive thought strategies and natural reward strategies. Individuals with self-leadership strategies choose the environments and activities in which they can achieve success, fulfill these activities or tasks, feel proud of them-selves (self-esteem) and are satisfied with life. Individuals use a series of cognitive, behavioral and emotional strategies in controlling their own behaviors, affecting themselves and leading themselves (Neck and Houghton, 2006; Unsworth and Mason, 2012). However, based on data obtained from the questionnaire, FGD and interview session, self-leadership's strategies are poorly or unwell implemented by freshmen. This can be deduced from poorly practiced self-leadership's thought pattern strategies, and poor time management culture of freshmen in Hawassa University. Individuals who do not make use of self-leadership strategies can have difficulty in setting goals and coping with stress, engage in unpleasant aspects of a task or activity and concentrate on the negative sides of life (Unsworth and Mason, 2012), and they may not be satisfied with life. In contrary to this, individuals who could act as self-leaders had high proficiency and positive feelings (Stewart et al., 2011); have the ability to use adaptive coping abilities (Wang et al., 2016); and knowledgeable about how to manage themselves and what road maps to follow in differing situations (Carmeli et al., 2006 and Georgianna, 2015). Therefore, self-leadership strategies function as effective mechanisms for freshmen to cope with a stress in a healthy way. In a sense, self-leadership is an individual's use of the effects he has on himself. Individuals with self-leadership strategies choose the environments and activities in which they can achieve success, fulfill these activities or tasks, feel proud of them (self-esteem) and are satisfied with life and can cope stress.

6.3 Correlations of self-leadership strategies and stress

Correlation analysis was applied to demonstrate the correlations between self-leadership strategies practiced with stress. There is a significant positive relationship or association between stress and self-leadership strategies in which the maximization of one can result the increase of another. In this study, liner regression analysis showed that of the self-leadership strategies, behavior-focused strategies significantly contributed to coping stress. This was consistent with the idea that self-leadership applications could have positive effects on self-esteem (Williams, 1997). Constructive thought strategies have been said to serve satisfaction by functioning as a source for the development of positive thought (Manz, 1992). In nutshell, as a significant predictor of stress is behavior focused strategies were found to have the strongest effect on coping stress followed by natural reward, constructive thought pattern and time management strategies.

7 Conclusions

Based on the findings from this study, this research indicates that the high level stress among freshman was academic stress while psychological stress, environmental stress and social stress of the students has leveled as moderate. Explicitly speaking, academic overload, difficulty in dealing with one's academic problems, and poor subject matter and pedagogical competence of instructors were among the academic stressors that inflict high academic stress. In regard to the environmental stressors, lack of electric supply, lack of well-functioning latrines and showers, water supply problem, computer and internet access problem, lack of recreational centers, lack of quality health service, and lack of adequate study rooms were found the most stressful items causing high level of environmental stress among the students. On the other hand, the study revealed that the student's self-leadership strategies are not effectively implemented by freshmen of Hawassa University. The study also revealed that there was a statistically significant relationship between the student's self-leadership strategies and their level of stress. As a result, there was a strong positive relationship between self-leadership strategies and stress. Regression analysis shows that the sub-scales of self-leadership strategies that are behavior-focused strategies, natural reward strategies, constructive thought pattern strategies, and time management have a significant contribution to coping stress. The beta coefficients show that for every one unit increase in the self-leadership strategies, there is a corresponding increase in the ability to cope with stress by .48, .26, .27, and .04 units, respectively, which indicates that behavior-focused strategies are the most influential strategies to cope with stress among freshmen.

8 Recommendations

1. Structured and integrated self-leadership training should be conducted for freshman students in continuous and systematic manner to strengthen the habits of self-leadership. It could have the dual effect of increasing self-leading behaviors, which may affect students future work habitude and also present studying practices improving students' accomplishments and intrinsic motivation.
2. Based on the finding, researchers recommend understanding freshman characteristics and planning freshman-oriented counseling, and assist students in adapting and enriching university students' campus engagement experiences, and promoting the enhancement of students' learning outcomes. Student counseling approaches could include psycho-education about different coping strategies and the relationship between emotional response and coping, as well as emphasize the role of awareness of one's emotions at different stages of dealing with stressors.

3. More importantly, the colleges should strengthen the provision of guidance and counseling services that deal with the mental health problems of their students and subsequently promote their psychological, social and emotional wellbeing.
4. Based on the study results discussed previously, university students must strengthen their club participation, teacher-student interaction, breadth of thinking, and development of multifarious abilities during their campus experience.
5. These findings have implications for universities' approach to orienting and supporting students through their academic tenure at their institutions. For example, student support offices could develop workshops and screening and monitoring programs to help prevent at-risk students from falling through the cracks. In addition, it could be helpful to tailor student programs so that they support students in developing a range of coping options and take into account their unique stressors and specific developmental stages.
6. In line with good communications and discussions (like seminars, meeting) with their students, more attention should be paid to improve the methods of teaching and the quality of study environment within our college campus. Some form of student support should be available in the form of mentoring and guidance to help in coping with stress and to educate the students about unhealthy consequences of stress. Moreover students should construct an effective time management program for studying and pleasure activities during their study years, in addition to adopting a healthy life-style in the context of physical, psychological, and spiritual wellbeing.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

Data Availability

Data can be made available on the behavior of the request

Declaration of interests' statement

The author declare no competing interests.

References

Abiyi, Y., et al. (2009). Research methods in education.
Abouserie, R. (1994). Sources and levels of stress in relation to locus of control and self-esteem in university students. *Educational Psychology*, *14*(3), 323–331.
Agolla, E. J. (2009). Occupational stress among police officers: The case of botswana police service. *Research Journal of Business Management*, *3*(1), 25–35.
Alise, M. A., & Teddlie, C. (2010). A continuation of the paradigm wars? prevalence rates of methodological approaches across the social/behavioral sciences. *Journal of Mixed Methods Research*, *4*(2), 103–126.
Arcağok, S., & Yılmaz, E. (2020). Teachers' perceptions of self-leadership.

Auerbach, M. S., & Gramling, S. E. (1998). *Stress management: Psychological foundations*. Prentice Hall.

Azila-Gbettor, E. M., et al. (2015). Sources of stress among students in a ghanaian university.

Bataineh, M. Z. (2013). Academic stress among undergraduate students: The case of education faculty at king saud university. *International Interdisciplinary Journal of Education*.

Biesta, G. (2010). Pragmatism and the philosophical foundations of mixed methods research. *SAGE Handbook of Mixed Methods in Social & Behavioral Research*, 95–118.

Burke, J. R., & Larry, C. B. (2008). *Educational research: Quantitative, qualitative, and mixed approaches*.

Carmeli, A., Meitar, R., & Weisberg, J. (2006). Self-leadership skills and innovative behavior at work. *International Journal of Manpower*, *27*(1), 75–90.

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education* (6th ed.). Routledge.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press.

Deribsa, A. (2017). *Research methodology handbook for research students and practitioners*. MEGA Publishing; Distribution PLC.

Eshetu, A. (2017). Research methods.

Feng, Z. (1992). Sources of psychological stress among college students.

Georgianna, S. (2015). Self-leadership and stress management.

Houghton, J. D., & Jinkerson, D. L. (2007). Constructive thought strategies and job satisfaction: A preliminary examination. *Journal of Business and Psychology*, *22*(1), 45–53.

James, L. R. (1982). Aggregation bias in estimates of perceptual agreement. *Journal of Applied Psychology*.

Kariv, D., & Heiman, T. (2005). Task-oriented versus emotion-oriented coping strategies: The case of college students. *College Student Journal*, *39*(1), 72–84.

Kitzrow, M. A. (2003). The mental health needs of today's college students: Challenges and recommendations. *NASPA Journal*, *41*(1), 167–181.

Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*(3), 607–610.

Kurikka, J. (2010). Self-leadership among university students.

Lazarus, R. S., & Folkman, S. (1984). Stress, appraisal, and coping.

Mahoney, M. J., & Arnkoff, D. B. (1978). Self-management: Theory, research, and practice. *Behavior Therapy*.

Manz, C. C. (1986). Self-leadership: Toward an expanded theory of self-influence processes in organizations. *Academy of Management Review*, *11*(3), 585–600.

Manz, C. C. (1992). Self-leadership... the heart of empowerment. *The Journal for Quality and Participation*, *15*(4), 80–85.

Manz, C. C. (2015). *Taking the self-leadership high road: Smooth surfaces or challenging waters?*

Manz, C. C., & Neck, C. P. (2004). *Mastering self-leadership: Empowering yourself for personal excellence* (3rd ed.). Pearson Prentice Hall.

Manz, C. C., & Sims, H. P. (1980). Self-management as a substitute for leadership: A social learning theory perspective. *Academy of Management Review*, *5*(3), 361–367.

Manz, C. C., & Sims, H. P. (2001). *The new superleadership: Leading others to lead themselves*. Berrett-Koehler Publishers.

Misra, R., & Castillo, L. G. (2004). Academic stress among college students: Comparison of american and international students. *International Journal of Stress Management*, *11*(2), 132–148.

Misra, R., & McKean, M. (2000). College students' academic stress and its relation to their anxiety, time management, and leisure satisfaction. *American Journal of Health Studies*, *16*(1), 41–51.

Myöhänen, T. (2010). Self-leadership in higher education.
Neck, C. P., & Houghton, J. D. (2006). Two decades of self-leadership theory and research: Past developments, present trends, and future possibilities. *Journal of Managerial Psychology*, *21*(4), 270–295.
Neck, C. P., & Manz, C. C. (1992). Thought self-leadership: The influence of self-talk and mental imagery on performance. *Journal of Organizational Behavior*, *13*(7), 681–699.
Neck, C. P., & Manz, C. C. (2007). *Mastering self-leadership: Empowering yourself for personal excellence* (4th ed.). Pearson Prentice Hall.
Neck, C. P., & Manz, C. C. (2010). *Mastering self-leadership: Empowering yourself for personal excellence*. Pearson Prentice Hall.
Patton, M. Q. (1990). *Qualitative evaluation and research methods*. Sage.
Ravid, R. (2011). *Practical statistics for educators*. Rowman & Littlefield Publishers.
Rout, U., & Rout, J. K. (1993). *Stress and general practitioners*. Kluwer Academic Publishers.
Scott, M. S. E. (2009). *Stress in college: Common causes of stress in college*. Lambert Academic Publishing.
Sofyan, H., et al. (2018). Prevalence of depression and anxiety among college students living in a disaster-prone region.
Stewart, G. L., Courtright, S. H., & Manz, C. C. (2011). Self-leadership: A multilevel review. *Journal of Management*, *37*(1), 185–222.
Sydänmaanlakka, P. (2005). *Intelligent leadership*. Pertec Consulting Oy.
Sydänmaanlakka, P. (2006). Intelligent leadership.
Tashakkori, A., & Teddlie, C. (2003). *Handbook of mixed methods in social & behavioral research*. Sage.
Thawabieh, A. M., & Qaisy, L. M. (2012). Assessing stress among university students. *American International Journal of Contemporary Research*, *2*(2), 110–116.
Unsworth, K. L., & Mason, C. M. (2012). Self-leadership and stress: The role of self-efficacy and coping.
Walton, R. L. (2002a). A comparison of perceived stress levels and coping styles of junior and senior students in nursing and social work programs.
Walton, R. L. (2002b). A comparison of perceived stress levels and coping styles of junior and senior students in nursing and social work programs.
Wang, Y., Xie, G., & Cui, X. (2016). Self-leadership and coping among college students.
Weirsma, W., & Jurs, S. G. (2009). *Research methods in education: An introduction*.
Williams, S. (1997). Self-leadership applications and self-esteem.
Yikealo, D., Tareke, W., & Karvinen, I. (2018). The level of stress among college students: A case in the college of education, eritrea institute of technology. *Open Science Journal*, *3*(4), 54–78.

Ethiopian Journal of Education Studies
OPEN ACCESS
ISSN(online): 27892875
Web link: https://journals.hu.edu.et/hu-journals/index.php/eies/

Original Article

Contributions of laboratory practical works to quality of science teaching-learning process and student learning engagement in Hawassa City Administration

Sisay Girma Sereto [1*] and Girma Moti [2]

[1,2] College of Education, School of Teacher Education, Hawassa University

ARTICLE INFO

Volume I, Issue I (2023)
https://doi.org/10.20372/0r0r3n83

CORRESPONDING EMAIL
* Corresponding author email: sisget2016@gmail.com

ARTICLE HISTORY
Submitted: 19 Apr. 2023
Accepted: 14 Jul. 2023
Published Online: 31 Jul, 2023

CITATION
Sereto, S.G. and Moti, G. (2023). Contributions of laboratory practical works to quality of science teaching-learning process and student learning engagement in Hawassa City Administration. *Ethiopian Journal of Education Studies*. Volume I, Issue I (2023), 53-67. https://doi.org/10.20372/0r0r3n83.

OPEN ACCESS
This work is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

KEYWORDS:
Facilities and equipment; laboratory practice; student learning engagement; teaching-learning process; pedagogical knowledge and skills

Abstract

The study examined contribution of laboratory practical works on quality of science teaching-learning process and student's learning engagement in secondary schools' classrooms. The study employed mixed method with quantitative driven embedded mixed (QUAN+qual) design. The researchers selected seven secondary schools from sixteen secondary schools using simple random sampling technique. The researchers selected 477 samples: 75 natural science teachers, 7 laboratory technician, 5 supervisors, 10 principals and 380 students using simple random sampling, availability, purposive and stratified followed by simple random sampling techniques. The researchers collected data from both primary and secondary sources using self-constructed questionnaires, unstructured interview, observation and document reviews. The researchers analyzed quantitative data using descriptive and inferential statistics and narrated qualitatively. The findings showed that laboratory practice is important for proper implementation of biology, chemistry and physics curricula. The learning experiences and activities of teachers and students did not align with the learning objectives. While the application of laboratory has values to the quality of teaching-learning process, the shortages of apparatus and equipment caused poor performance of students and inequitable quality of teaching-learning process. The study recommends that principals, supervisors, science teachers and laboratory technicians should be responsible bodies to improve students and teachers' participation in laboratory practical works by fulfilling necessary laboratory facilities and equipment.

1 Introduction

Education is essential to consider for the reason that can open up the potential possessed by the students for better understanding of the world and to overcome existing problems. Education improves one's self-quality; it requires a process of learning science (Mena et al., 2016; Kilinc et al., 2017; Girma, 2022). In addition, at the center of accelerating UN SDG4, education transforms the experiences and competencies of groups of people from one generation to the next generation (United Nations, 2015). The SDG4 targets toward transforming quality of education (UNESCO, 2019). Excellence in education, curriculum,

school and teaching philosophies demand dialogic and collaborative forms of practices and prominent contextualization of innovative ideas of teachers and learners (Al-Balushi, 2017; Girma, 2022). Enhancing the quality of science teachers creates competent teachers having deep-rooted knowledge, skills and attitudes required in classrooms at any time.

The teaching and study of sciences encourage and enable students to attain broader objectives of science which cover scientific inquiry to design and carry out scientific investigations and evaluate scientific evidence to draw conclusions, communicate scientific ideas, arguments and practical experiences, demonstrate attitudes and develop values of honesty and respect for themselves, others and shared environment (Ezeh, 2016).The development of science over the years exerted influences and dominated every aspect of human endeavor in such a way that individuals devoid of science literacy find out very difficult to survive in the contemporary society (Chinyere et al., 2014). The laboratory practical work enables learners to engage actively in practice and lead them towards conceptual comprehension activities (Millar, 2010).

The paradigm shift from teacher-centered method of teaching to student-centered learning is indispensable to make students take the position of constructivists through developing positive interdependence, self-confidence, communication and information processing skills and critical thinking because of higher order thinking and learning practices (Girma, 2022). In science, hands-on and minds-on practical works provide learners with opportunities to question, observe, experience and experiment with scientific phenomena (Rec, 2019). Learners tend to appreciate things seen more than spoken. A student can easily understand the concepts when he/she is involved in the practical activities that are following certain procedures, data collection and conclusions. The theoretical and practical parts of science need not to be isolated but taught as segments portions of a subject and not as a different entity. A practical work is beneficial to learners through interactions, hands-on activities, and application in science (Hampden-Thompson and Bennett, 2013).

In the Ethiopian context, biology, chemistry and physics teaching with the help of laboratory seems to have been recognized long ago. In secondary school curriculum many effort has been done at different time in view of achieving these aims of science teaching either by designing new or by revising existing curricula. The policy document of Ethiopia emphasizing the importance of science education states that, the teaching and learning of science enables students to understand scientific concepts and there by interdependability develop rational thinking and problem solving in their daily life and develop scientific skills to achieve scientific judgments (Ministry of Education, 2018). Learning science is enhanced and the understanding level is improved when students are engaged in science laboratory for practical experiments (Hofstein and Lunetta, 2004). Science (biology, chemistry and physics) laboratory practical works enable learners to evaluate and test scientific concepts, develop scientific skills via hands-on and minds-on interventions. Science practical work is enjoyable for learners and enhances the effectiveness of learning science which further improves student engagement to reach positive outcomes (Gunuc and Kuzu, 2016). Therefore, although few studies about science laboratory practical works on teaching-learning and student engagement and achievement were conducted worldwide, related problems are not thoroughly investigated in Ethiopian in Hawassa City administration.

Although science is grounded on inquiry-based approaches, experiments and practical laboratory, the researcher experience and observed that the effectiveness of these practices are not satisfactory in the teaching-learning process in secondary schools. Although laboratory practical work has pivotal roles in enhancing science concepts and sharing learning experiences in teaching and learning process (Kurt, 2020). The appropriate use of school-based laboratory practice improves science skills of students in classrooms. The implementations of laboratory practice in science education at secondary schools in many countries are effective because of the attention given to it (Beyessa, 2014). How-

ever, in the Ethiopian context, the implementation process of science instruction is limited and students perform poorly in science subjects (Samuel and Welford, 2000). Laboratory practice is necessary in secondary schools to help students understand the theoretical knowledge of science and provides relevant experiences to learners. Therefore, it encompasses a combination of instructions, accompanied by practical demonstrations and range of laboratory activities. In line to this, experience is critical as learning occurs through discovery and active participation since knowledge is created through transformation of experience (Kolb and Kolb, 2005; Kurt, 2020).

Contextually, the implementation of laboratory practical work in our context is full of drawbacks which inhibit the achievement of science objectives. Many students face problems to perform well in science lessons because of lack of practical lessons, inadequacy of instructional material such as laboratories, chemicals, models, apparatus, local specimens and shortage of textbooks (Muleta et al., 2016). For instance, the shortage of allocated practical time and irregularity of carrying out practical lessons by science teachers affect student performance and understanding (Owino et al., 2014). A secondary school laboratory needs recent equipment necessary to conduct meaningful experiments and teachers" skills and knowledge that enable them share students" full laboratory experiences with appropriate accommodation and laboratory assistants (Tenaw, 2015). This shows that the 21st century science laboratory requires the 21st century latest laboratory rooms equipped with modern laboratory technologies, apparatus, chemicals and innovative pedagogical knowledge and skills.

The researcher was motivated and inspired to conduct this study because study conducted in the local surrounding has conceptual, knowledge and methodological gaps though they put milestones. The existing laboratory practices or experiments did not able to improve secondary schools" students practical knowledge and skills, and unable to gear their potentials towards science and technology driven instructional system. The researcher conducted this study to create possible solutions to improve the quality of teaching-learning process via proper implementation of science laboratory practical work. Therefore, this study examined the contribution of laboratory practice on quality of science teaching-learning process and student's learning engagement in government secondary schools' classrooms in Hawassa city administration, Ethiopia.

1.1 Objectives

The main purpose of the study was to examine the contribution of laboratory practice on quality of science teaching-learning process and student's learning engagement in secondary schools in Hawassa City administration. More specifically, the study helps to:

1. Evaluate the quality of science teachers" and laboratory technicians" pedagogical skills to plan and implement laboratory in secondary schools.
2. Examine the extent to which science teachers and students are motivated to implement laboratory in secondary schools.
3. Examine the extents to which laboratory facilities, equipment and materials are accessible to implement laboratory in secondary schools.
4. Evaluate participation passion of students in science laboratory practices in secondary schools.
5. Identify major factors affecting science laboratory practical work and student-learning engagement.

1.2 Research questions

The central research question was, to what extent does laboratory practices improve quality of science teaching-learning process and student's learning engagement in secondary schools in Hawassa City administration?" In addition, the study answered the following specific questions. These are:

1. What do the pedagogical skills of science teachers and laboratory technicians look-like to plan and implement laboratory to improve quality of teaching-learning process?
2. To what extent are science teachers and students motivated to implement biology laboratory practical work to improve quality of teaching-learning process?
3. To what extents are laboratory facilities, equipment and materials accessible to implement laboratory?
4. To what extents are secondary schools' students engage in laboratory practical work?
5. What major factors affect science laboratory practical work and student engagements?

1.3 Significance

The study has policy, academic and practical significance. It helps natural science (biology, chemistry and physics) teachers, principals and laboratory assistants recognize the problem encounter implementation of science laboratory and set relevant strategies to solve the existing problems. It enables students to explore learning opportunities that focus on interacting with learning materials and improves students" understanding of science concepts and problem solving-skills. This research work helps policy makers, curriculum developers and other concerned bodies can devise means to create solutions alleviate the existing problems. It further helps the schools to use the findings of the study to improve laboratory practice and fulfill laboratory equipment.

2 Research Methods

2.1 Research design

Research design is a plan and techniques for inquiry that extent decisions from broad assumptions to detailed methods of data collection and analysis (Creswell, 2014). Accordingly, the researchers used quantitative driven embedded mixed (QUAN+qual) design throughout this study (Creswell and David, 2018). It is less time consuming because both qualitative and quantitative data collection occurs concurrently (Creswell and David, 2018) happened with the dominant leading practices of quantitative investigation.

2.2 Research method

For this study, the researcher employed mixed method because mixed method is convenient for social and human science as distinct research, which is used to cover a basic deficiencies and description of the study (Creswell, 2014). Mixed methods studies are studies that are products of the pragmatist paradigm and that combine the qualitative and quantitative approaches with in different phases of the research process (Tashakkori and Teddlie, 2008).

2.3 Sources of data

To obtain valid and reliable information, the uses of appropriate data sources are vital. Therefore, in this study, both primary and secondary data were used for triangulation (Cohen et al., 2018).

2.4 Primary sources of data

The primary sources of data include: grade ten and eleven students, grade ten and eleven science (biology, chemistry and physics) teachers, supervisors, principals and laboratory technicians were included in this study.

2.5 Secondary sources of data

The secondary sources of data were collected from articles, published and unpublished thesis, reports, journals, student's roasters, attendance, documents and books written on the issues of laboratory work of science education.

2.6 Sample and sampling techniques

In this study, the source population includes science teachers, students, principals and laboratory technicians. Science teachers and students were considered important level academic policy in their respective schools. In addition, laboratory technicians serve in the schools as teachers" supporters and assist science teachers while preparing specimens, arranging the equipment, arranging laboratory materials, chemicals and log records of laboratory works.

The researcher selected seven schools out of sixteen secondary schools using simple sampling technique. The researcher determined a sample size for the large target population (e.g. students) by using the Cochran (1977) from the total of 7680 students, 380 students were selected using simple random sampling technique. Out of 120 science teachers 75 teachers were selected using simple random sampling, 5 supervisors and 10 principals were selected using purposive sampling techniques based on their appropriate position to give relevant data, whereas 7 laboratory technicians were selected using availability sampling techniques because of their manageable size. The data were collected using questionnaires, interview, and observation. The researcher analyzed the data using descriptive statistics using tables and triangulated it qualitatively by thematic narration. The researchers further determined a sample size for the large target population (e.g. students) using Cochran (1977) to decide the numbers of sample personnel in secondary schools who play pivotal roles in the implementation and operation of the teaching-learning process including laboratory practice. Similarly, principals have significant responsibilities in planning and formulating overall school-determined to select 380 samples from 7680 grades 10 and 11 students. Then, the researcher selected the samples using stratified sampling technique and proportionality followed by simple sampling random sampling technique from each stratum. Of this figure, 380 sample secondary school students actively participated in the study.

$$\mathrm{n} = \mathrm{N}1 + \mathrm{N}(e)2$$

2.7 Data collection tools

This study used different data collection tools to enrich each other. This helps to solve inadequacies of data (Creswell and David, 2018). These include: interviews, questionnaires, observation and document review.

Questionnaires: Self-constructed questionnaire helped the researchers to obtain first-hand information about the perception of teachers and students (Creswell, 2014). An open and closed ended item that cover a wide range of themes prepared and administrated to students and science teachers. To cross-check the reliability and validity of questionnaire, the draft questionnaires administered to students and science teachers from nonsample group had been piloted. After the questionnaires were filled by the respondents each questionnaire examined to detect unclear ideas and statements. Finally, based on the feedback from the pilot test, some of the items were improved and lastly the refined copies of the questionnaires distributed for sampled respondents.

Interview: Any person to person interaction between two or more individuals with a specific purpose in mind is an interview (Yin, 2018). The researcher made unstructured interview with supervisors, principals and laboratory technicians face-to-face by taking note and recording their voices based on their willingness.

Observation: Observations check lists were employed to gather necessary data concerning laboratory equipment's, facilities of laboratory, practices, and instructional methods of science (biology, chemistry and physics) curricula.

Document reviews: To confirm the primary data with the facts available in documents, guideline, reports and checklists were considered as a source of information. Document analyses were used to cross check the correspondence between what respondents responded and what they practically did.

2.8 Data collection procedures

In order to obtain adequate information in this study, the researcher prepared data gathering instruments. The questionnaires were prepared in English because all respondents understood the ideas and concepts of the questionnaires and filled out them on time. The responses were also obtained through observation, interview and document analysis.

2.9 Validity and reliability

Validity was checked by educational experts through proof reading whereas reliability was checked through Cronbach alpha results post pilot testing. A pilot study was conducted before the actual study in none-sample two government secondary schools. This pilot test helped to check up the reliability of the instruments and to know the existing states of potential respondents with respect to the problem under study. The calculated alpha values for teachers and students were .807 and .843 respectively. Therefore, the researchers modified some questionnaires before final data collection.

2.10 Method of data analysis

The data gathered through primary and secondary sources were analyzed using mixed data analysis methods. The quantitative data collected using closed-ended question-

naires were analyzed quantitatively using SPSS-26. The researchers used and descriptive (percentage, mean, standard deviation), and inferential statistics (t-test). The data were collected from 477 respondents (75 science teachers, 5 supervisors, 10-principals, 7-laboratory technicians, and 380 students). The qualitative data were obtained from open-ended questionnaires, interviews and observation, and supported by secondary data collected via document reviews, and qualitatively narrated in themes using NVivo-14 software. The data collected through closed-ended questionnaire were analyzed using descriptive and inferential statistics using SPSS version-26.

3 Results

Based on embedded mixed design (QUAN+qual) procedures, the results of the study were discussed by analyzing the results of different sources such as questionnaires, unstructured interview, observation and document review.

3.1 Demographic characteristics of respondents

Table 1: Information of the respondents

Categories		Frequency	Per cent
Respondents	Teachers	75	15.72
	Principals	10	2.10
	Supervisors	5	1.05
	Laboratory technician	7	1.47
	Students	380	79.66
	Total	477	100.0

Table 1 showed that the respondents: science teachers, principals and laboratory technicians accounted 97 (20.34%) and students accounted 380 (79.66) of the total participants of the study.

Table 2: Genders of student respondents

Categories		Frequency	Per cent
Gender	Male	204	53.68
	Female	176	46.32
	Total	380	100.0

Table 2 showed that regarding the gender of respondents, 204 (53.68%) of the respondents were males and, 176 (46.32%) of the respondents were females. Both sexes are nearly approaching to each other, so that the researchers obtained relatively accurate information from both sexes.

Table 3: Ages of respondents

Categories		Frequency	Per cent
Age	15-20	380	79.66
	21-30	44	9.22
	31-40	19	3.98
	41-50	22	4.61
	Above 50	12	2.52
	Total	477	100.0

Table 3 showed that 380 (79.66%) of students were between the age of 15-20, 44 (9.22%) were between the age of 21-30, 19 (3.98%) respondents were between the age group of 31-40, 22 (4.61%) respondents were between the age of 41-50 and lastly, 12 (2.52%) of the remaining respondents were above the age of 50.

Table 4: Educational status of the respondents

Educational status		Frequency	Per cent
Students	Grade 10 and 11	380	79.66
Laboratory technicians	Diploma	40	8.39
Teachers	First Degree	40	8.39
	MSc/MA	7	1.47
Principals	MSc/MA	10	2.10
	Total	477	100.0

Table 4 showed that grades 10 and 11 Students accounted for 380 (70.66%). 40(8.39%) were of respondents were diploma holders, 40 (8.39%) respondents first degree holders, and the remaining 17 (3.57%) were MSc/MA. The education level of respondents relate to their profession and academic status so that we can assume that the information provided by the respondents was valid and reliable.

Table 5: Work Experience of principals, supervisors science teachers and technicians (n=97)

Category	Work experience	Frequency	Cumulative Percent
Experiences	1-5	12	13.04
	6-10	38	41.30
	11-15	22	23.91
	16-20	6	6.52
	28 and above	19	15.22
	Total	97	100.0

Table 5 revealed that the work experience of the respondent, 12 (13.04%) of them have work experience between 1-5 years, 38 (41.30%) of the respondents have work experiences between 6-10 years, the other 22 (23.91%) of the respondent has work experience above 11-15 years, 6 (6.52%) of the respondents have work experience between 16-20. In addition, 19 (15.22%) of the respondents have 21 and above work experience.

3.2 Awareness and motivation about science laboratory practices

The data collected from a total of 477 respondents: 455 respondents using questionnaires and 22 participants using interview covered four themes: awareness and motiva-

tion of teachers regarding the significance of laboratory practices, the status of laboratory practice, accessibility of laboratory facilities and students learning engagement and achievement.

Table 6: Awareness and motivation of science teachers (n=445)

Sources of Variation	Category of the Respondents	n	M	Std. Error
	Teachers	72	2.35	0.599
	Students	31	1.85	0.431

In addition, while responding to the question "how do you evaluate motivation and commitment of science teachers, laboratory technicians and students on the implementation of laboratory?", one of the principal interviewee stated that

Science teachers, laboratory technicians and students lack commitments and motivation to implement science practical work. I think science teachers are not preparing themselves and willing to implement laboratory practical work in laboratory rooms because it is time taking and tiresome" (ISP1, March, 20/2023).

Unlikely, the other principal interviewee discussed that

Science teachers, laboratory technicians and students are committed, motivated and are participating actively in the laboratory experimental work in my school. Therefore, it is a good opportunity for students to develop their practical knowledge and skills by actively participating in the experiments" (ISP5, February, 28/2023).

From observation, the researcher witnessed that there was no any commitment and motivation regarding secondary school laboratory practical work except that of one laboratory technician and some students" interests towards the practice (Ob1, Ob2 & Ob6, February-March, 2023).

The quantitative and qualitative data deduced that the awareness, motivation and commitment of science teachers, lab technicians and students towards implementation of laboratory practical work is not encouraging to ensure quality of teaching and learning process.

3.3 Status of science laboratory practice

Table 7: The status of science laboratory practice (n=445)

Sources of variation	Category of the Respondents	N	Mean	Std. Deviation
The Status Of Science	Teacher	72	2.39	0.483
	Student	31	1.89	0.431

Mean value: Note: Mean value $<$ 3.00 - Poor; 3.00 - Ideal (average); 3.01-3.49 - Good; $>=$ 3.50 - Very good.

Table 7 showed that the mean responses of both science teachers and students lied below the expected ideal mean regarding the status of biology laboratory practical work implementation MT = 2.39 & MS = 1.89. This showed that there is low status which ranged from very poor to poor average means of science teachers laboratory implementation.

Table 8: Independent sample t-test on the status of science laboratory practice (n=455)

		t	df	Sig.
The Status of Science	Equal variances assumed	0.195	101	0.846

Table 8 showed that there was no a statistically significant difference between the means of science teachers and students indicating that there are low status of laboratory practical work implementation where the difference [M (t) = 0.195 > 0.014]. This indicates there are no opinion differences between teachers and students.

In addition, while responding to the question "how do you evaluate the pedagogical knowledge and skills of teachers and lab technicians in the implementation of laboratory practical work?" one of the principal interviewee stated that

The pedagogical knowledge and skills of science teachers and laboratory technician are not encouraging to implement the practical laboratory works in classrooms. I think they have meager experiences, attitudes, knowledge and skills of pedagogical practices in laboratory classrooms" (ISP3, March, 20/2023).

The other principal interviewee further demonstrated that

Science teachers and laboratory technician lacked specific pedagogical knowledge and skills in order to implement laboratory practical work. I am sure that they lack experiential learning while they were taking training and learning in their previous colleges. This shortage constrained their pedagogical experiences of laboratory practice in laboratory sessions" (ISP5, February, 28/2023).

From observation, the researcher witnessed that laboratory rooms were old, dilapidated and not conducive for practice. It is important that the practical learning environment is conducive for teachers and learners to become interested in laboratory practice. An ideal secondary school laboratory must be clean and not decayed. A number of students are greater than the standard to conduct practical work in laboratory rooms (Ob1, Ob2 & Ob6, February-March, 2023).

Both quantitative and qualitative data revealed that the status of science laboratory practice in the sample secondary schools was poor because of several shortcomings such as decay of the physical facilities being aged and old, large number of students beyond the standard of MoE (1:25), failure of updating with new technological and pedagogical facilities.

3.4 Accessibility of laboratory facilities

Table 9: Accessibility of laboratory facilities (n=455)

Sources of Variation	**Category of the Respondents**	N	Mean	Std. Deviation
Accessibility of Laboratory	Teacher	72	2.12	0.673
	Student	31	1.93	0.602

Table 9 showed that the mean of responses of both teachers and students lied below the expected ideal mean regarding the accessibility of laboratory facilities MT = 2.12, & MS = 1.93) This ranged from poor to very poor indicating that there are shortages of laboratory facilities to conduct biology practical work in the laboratory.

Table 10: Independent sample t-test on accessibility of laboratory facilities (n=455)

		t	df	Sig.
Accessibility of Laboratory	Equal variances assumed	0.588	101	0.558

From the interview, one of the laboratory technician interviewee stated that

The school administrative bodies have no interest to fulfill laboratory materials to improve quality of science learning. They think fulfilling the laboratory as high expenditure of resources (ILT1, Feb 28, 2023)

Later on, the other laboratory technician interviewee discussed that

The lack of laboratory equipment, apparatus and chemicals made the practice difficult for science teachers to teach practical work in the laboratory. Relatively, biology and chemistry equipment are available although they are outdated unlike to physics" (ILT4, March, 20/2023).

From observation, the researcher witnessed that laboratory facilities, e.g., apparatus were insufficient and inadequate supply of chemicals. Most laboratories have expired chemicals. The laboratory was not well organized (Ob1, Ob2, Ob3, Ob4 & Ob6, February-March, 2023).

Moreover, the document analysis showed that there is no alignment between teacher guide, student's textbook and the real practices. And, also from the seven sample schools, only one school has laboratory manuals and reports (Feb-March 2023).

Therefore, one can come up with the existing realities based on quantities and qualitative data that the accessibility of laboratory facilities was below ideal mean indicating that science teachers, lab technicians and students were not properly implementing laboratory practical work in the sample secondary schools.

3.5 Student's Learning engagement and achievement

Table 11: Student's Learning engagement and achievement (n=455)

Sources of Variation	**Category of Respondents**	N	Mean	Std. Deviation
Student learning	Teacher	72	1.91	0.444
	Student	31	1.85	0.830

Table 11 showed that the mean of responses of both teachers and students lied below the expected ideal mean regarding to learning engagement and achievement of students (MT= 1.91 & MS =1.85). This shows that the means of respondents summarize that there was very poor students" learning engagement and achievement of students because of meager experimentation of laboratory activities.

Table 12: Independent sample t-test learning engagements and achievement (n=455)

		t	df	Sig.
Student learning	Equal variances assumed	0.471	101	0.639

The findings of the study demonstrated that the awareness, motivation and commitment of principals, science teachers, lab technicians and students towards laboratory practical work were not encouraging to ensure qualities of teaching-learning process. Therefore, they lack a clear understanding about the importance of practical work to develop students" competencies and skills. The finding further revealed that the status of science laboratory practices and physical facilities in the sample secondary schools was poor because of several shortcomings associated with decay of the physical facilities of the laboratory, becoming aged and older, lack of teachers" and lab technician's pedagogical training, large number of students beyond the standard of MoE (2018) i.e the ratio is 1:25, failure of updating with new technological and pedagogical innovations.

The findings of the study remarked that the status of students" learning engagements in laboratory practical work in the sample secondary schools was very poor and there was no change in their academic achievement from time to time. The students" learning engagement and outcomes require improvements teachers" continuous professional learning to update their professional and pedagogical competencies, and students" positive interdependence, individualistic accountability, social skills, communication skills and group processing skills (Girma, 2022). In response to this, Holstermann et al. (2010) further recommended that students who carried out experiments in some science lessons (e.g. detection of products of photosynthesis, and osmosis) were more engaged compared to students who did not conduct experiments. This signifies the importance of student's engagement in laboratory practical work.

The status of laboratory practice in sample government secondary schools was low because of poor engagement of science teachers, lab technicians and students in practical work. According to Lake (2004), students need to be involved in practical activities that will enhance their acquisition of higher-order processing skills rather than lower-order thinking skills. Teachers" professional learning practices improve their professional and pedagogical competencies and skills, and ultimately utilization of learner-centered instruction like cooperative learning, laboratory practical work and group discussion (Girma, 2022). This practice improves students" positive interdependence, individualistic accountability, social skills, communication skills and group processing skills, students" learning engagement and outcomes. Therefore, learners do the practical themselves under teachers" supervision and handle the apparatus during the practical if they are to be successful in practical examinations.

4 Conclusions

The findings obtained through questionnaires, observation guidelines and document review revealed that there is a statistically significant relationship between the availability of laboratory facilities and students" learning engagements. The traditional teaching strategy is the most dominant way of implementing the practical work in the sample schools. Still a lot of barriers hinders the implementation of laboratory work and force the teachers toward choosing traditional methods which was critically discussed in the literature review. These problems put high pressure on science teachers and students, and negatively influenced intrinsic motivation of learners implementing laboratory practical work. Natural science teachers and laboratory technicians lack pedagogical skills to manage laboratory practical work in the laboratory classrooms. The inadequate laboratory facilities also hindered meaningful science instruction in secondary schools and contributed to persistent poor performance of students.

5 Recommendations

The researchers observed that the secondary schools have a shortage of resources such as chemicals and apparatus on top knowledge and skill gaps regarding laboratory practice. Therefore, school principals should provide adequate resources needed during practical lessons for better learning of practical work. Principals should visit laboratory in their secondary schools regularly to identify the problems that teachers and laboratory technician are facing while conducting practical work. For instance, the gaps of pedagogical knowledge and skills they face in laboratory rooms.

Natural science teachers and laboratory technicians should ensure that students engagement in practical exercise in their schools through improving own awareness and commitment. However, in the absence of standard laboratory facilities, improvisation should be encouraged and used which may provide the opportunity for creativity and innovations in both the teachers and laboratory technicians. Science teachers are recommended to motivate and encourage students to develop interest in practical activities by providing instructional materials that will challenge them to be actively involved during practical lessons.

Natural science teachers and laboratory technicians should practice the five principles of E's (5Es) (engagement, exploration, explanation, elaboration and evaluation) while implementing laboratory practical work in secondary schools. Although all students should be motivated and committed to learn science in practical way, students are recommended to be engaged in science laboratory practice to obtain good results and for the development of future science works. In addition, teachers' College of education is recommended to help science teachers on the assessment of practical skills acquired by the learners, and training workshops for the teachers should be held on how to design practical activities and conduct science experiment in the laboratory rooms. Generally, recommendations should be forwarded for specific groups or concerned bodies who can alleviate the problems mentioned in the study. In this regard the recommendations have to be written again by listing the concerned bodies such as for district education bureaus, principals, teachers and laboratory technicians.

6 Limitations and implications for scientific communities

This study was not accomplished without limitations and the researchers tried to provide clear picture through making proper analysis of different variables considered although it requires further interventions through lesson-based study.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

Data Availability

Data can be made available on the behavior of the request

Declaration of interests' statement

The author declare no competing interests.

References

Al-Balushi, K. (2017). They feel that they have a voice and their voice is heard: Towards participatory forms of teachers' in oman.

Beyessa, F. (2014). Implementation of laboratory practice in science education.

Chinyere, N., et al. (2014). Science literacy and the contemporary society.

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). John Wiley; Sons.

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Creswell, J. W. (2014). *Research design: Qualitative and mixed approaches* (4th ed.). Sage Publication.

Creswell, J. W., & David, C. J. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications, Inc.

Ezeh, D. N. (2016). Influence of gender and location on students' achievement in chemical bonding. *Mediterranean Journal of Social Sciences*, *7*(3), 309–318.

Girma, M. G. (2022). The effects of teachers' professional and pedagogical competencies on implementing cooperative learning and enhancing students' learning engagement and outcomes in science: Practices and changes. *Cogent Education*, *9*(1), 1–22.

Gunuc, S., & Kuzu, A. (2016). Assessment & evaluation in higher education student engagement scale: Development, reliability and validity. *Assessment & Evaluation in Higher Education*, *12*(2), 29–38.

Hampden-Thompson, G., & Bennett, J. (2013). Science teaching and learning activities and students' engagement in science. *International Journal of Science Education*, *35*(8), 1325–1343.

Hofstein, A., & Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. *Science Education*, *88*, 28–54.

Holstermann, N., Grube, D., & Bögeholz, S. (2010). Hands-on activities and their influence on students' interest. *Research in Science Education*, *40*(5), 743–757.

Kilinc, A., Demiral, U., & Kartal, T. (2017). Resistance to dialogic discourse in ssi teaching: The effects of an argumentation-based workshop, teaching practicum and induction on a pre-service science teacher. *Journal of Research in Science Teaching*, *54*(6), 764–789.

Kolb, A. Y., & Kolb, D. A. (2005). Learning styles and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning & Education*, *4*(1), 193–199.

Kurt, S. (2020). Kolb's experiential learning theory and learning styles. *Educational Technology*.

Lake, D. (2004). What makes a students' science investigation more scientific? *School Science Review*, *85*(312), 107–112.

Mena, J., Garcia, M., Clarke, A., & Barkatsas, A. (2016). Analysis of three different approaches to student teacher mentoring and their impact on knowledge generation in practicum settings. *European Journal of Teacher Education*, *32*(1), 234–249.

Millar, R. (2010). Practical work.

Ministry of Education. (2018). *Ethiopian education and development roadmap (2018-2030)* (tech. rep.). MoE. Addis Ababa.

Muleta, D. T., Anbassa, B., Kere, O. B., & Degefa, I. (2016). Status of biology laboratory and practical activities in some selected secondary and preparatory schools of borena zone, south ethiopia. *Educational Research and Reviews*, *11*(1), 1709–1718.

Owino, O. A., Ahmad, O., & Yungungu, A. (2014). An investigation of factors that influence performance in kcse biology in selected secondary schools in nyakah district, kisumu country, kenya. *Journal of Education and Human Development*, *3*(2), 957–1000.

Rec, M. (2019). Hands-on and minds-on practical works in science.

Samuel, B., & Welford, A. G. (2000). Practical activities in ethiopian secondary physical sciences: Implications for policy and practice of the match between the intended and implemented curriculum. *Research Papers in Education*, *15*(1), 185–212.

Tashakkori, A., & Teddlie, C. (2008). *Introduction to mixed method and mixed model studies in the social and behavioral science*.

Tenaw, Y. A. (2015). Effective strategies for teaching chemistry. *International Journal of Education*, *3*(3), 78–92.

UNESCO. (2019). *Beyond commitments: How countries implement sdg4* (tech. rep.). Global Education Monitoring Report. Paris, France.

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development* (tech. rep.). UN.

Yin, R. K. (2018). *Case study research: Design and methods* (5th ed.). Sage.

Ethiopian Journal of Education Studies
OPEN ACCESS
ISSN(online): 27892875
Web link: https://journals.hu.edu.et/hu-journals/index.php/eies/

Original Article

Perception and performance of secondary school science teachers' inquiry-based methods of teaching in Hawassa University Technology Transfer Villages

Girma Moti Geletu [1*], Janbo Guduru Figa [2] & Seboka Geleta Tonkolu [3]

[1,2,3] School of Teacher Education, Hawassa University

ARTICLE INFO

Volume I, Issue II (2023)
https://doi.org/10.20372/k2kqb106

CORRESPONDING EMAIL
* Corresponding author email: girmam2015@gmail.com

ARTICLE HISTORY
Submitted: 05 May, 2023
Accepted: 18 Jul, 2023
Published Online: 31 Jul,2023

CITATION
Geletu, G.M., Figa, J.G. and Tonkolu, S.G. (2023). Perception and performance of secondary school science teachers' inquiry-based methods of teaching in Hawassa University Technology Transfer Villages. *Ethiopian Journal of Education Studies*. Volume I, Issue II (2023), 68-84. https://doi.org/10.20372/k2kqb106.

OPEN ACCESS
This work is licensed under the Creative Commons Attribution 4.0 International License (CC BY 4.0).

KEYWORDS:
Science teaching;
inquiry-based methods of teaching;
perception and performance of teachers;
professional and pedagogical competencies;
instructional materials;
scientific methods

Abstract

The study investigated perception and performance of secondary school science teachers' inquiry-based methods of teaching in Hawassa University technology villages. The researchers employed mixed method with quantitative driven embedded mixed (QUAN+quan) design. The primary sources of data were principals, department heads, and teachers. The researchers selected participants using availability, purposive, and stratified sampling techniques. The researchers' collected data using questionnaires, interview, and observation from data sources. The researchers analyzed quantitative data by using frequency, percentages, mean, independent sample t-test and one-way-ANOVA using SPSS-26. The data obtained through interviews and observations was qualitatively narrated under their main themes using NVivo-14 software. The findings of the study revealed that science teachers positively perceived inquiry-based teaching methods regardless of their implementation. Despite of respondents' positive perception, the practices of inquiry-based teaching methods in science were limited, and that there were no statistically significant differences of means of respondents. The major challenges those impeded teachers from implementing inquiry-based teaching methods were lack of instructional materials, absence of laboratory equipment, chemicals, manuals and lab-technicians, large class size, lack of creativity and innovation among teachers and lack of teachers' competences. Therefore, the study recommended that school of teacher education, district educational offices and schools should enhance teachers' performance via devising necessary professional and pedagogical training.

1 Introduction

Inquiry in science education has a long and complex history; the term "inquiry" is grounded in the ideas of key educators such as Dewey (1996) and Bruner (1960). John Dewey has rooted inquiry in experience and described the pattern of inquiry, which is located in human culture, language, and everyday experience. According to Dewey, learning experiences should be collaborative and placed in the context of the reconstruction of knowledge. Moreover, Girma (2022) suggested that teacher's professional and pedagogical competencies play paramount importance in implementation of various active

learning strategies (cooperative learning, differentiated instruction and micro-teaching) in classrooms.

Recently, there has been a pedagogical shift in contemporary curriculum theory aimed at encouraging teachers to incorporate scientific inquiry into their practice as a means to enhance learners' interest in science (Dillon, 2009; Gudyanga and Jita, 2019). The inquiry-oriented approach emanated from the appreciation of the fact that learners' interest in science subjects develops through a process that allows them to obtain scientific knowledge by investigating phenomena rather than listening to the teacher and summarizing main ideas. Keller et al. (2016) stated that inquiry-based teaching is a major determinant and predictor of learner motivation and teachers' self-efficacy. Besides, Chen et al. (2018) stated that inquiry-based teaching is a relatively new and innovative practice that requires learners to carry out scientific investigations instead of cramming facts from a textbook.

In supporting the above ideas, the National Research Council (2000) described that when students are involved in inquiry, they go through the five steps that constitute the essential features of inquiry. Firstly, learners are engaged by scientifically-oriented questions. In the best of cases, these questions should come from the students, even though often they are provided by the teacher. Secondly, learners give priority to evidence, allowing them to develop and evaluate explanations that address these scientifically oriented questions. Here, the teacher does not simply provide recipe-like instructions for each experiment; rather, learners plan and decide how experiments are to be conducted. Thirdly, learners formulate an explanation based on evidence to address scientifically oriented questions. This explanation should refer to the initial question they were trying to answer. Fourthly, once students have made the explanation based on the data they collected, they evaluate it and consider whether it fits into the evidence they already have. Lastly, learners communicate and justify their proposed explanation. Each of these features of inquiry hen applied in a classroom, it varies both in terms of the amount of learner self-direction on the one hand and the amount of the teachers or material's direct involvement on the other hand. Through this process, science teachers create an enabling learning environment. Moreover, Zoller (2011) discussed that science learning should require the development of students' ability to be engaged in higher-order cognitive skills based on forms of inquiry such as question-asking, critical thinking, evaluative system thinking, decision-making, and problem-solving capabilities in dealing with characteristically interdisciplinary everyday life. An important element in this higher-order cognitive skills model presented by Zoller (2011) is the transfer capability, which is the capability of transferring different learning situations into real-life problem-solving contexts. Therefore, inquiry-based education proves vital, especially with respect to achieving complex and comprehensive "higher-order" objectives such as understanding science principles, comprehending scientific inquiry, and applying scientific knowledge to personal and societal issues (Anderson, 2002). Hence, inquiry pedagogies emphasize, among others, the teacher's role: a shift from "dispenser of knowledge" to facilitator or coach for supporting students' learning. Because of this, the role of the teacher switches from being the authority to becoming a guide who challenges students to think beyond their current processes by offering guided questions and preparing wisely planned scaffolds (Anderson, 2002; Windschitl, 2002).

Inquiry-based teaching improves the quality of teaching and learning in the natural sciences. At the same time, it encourages the teachers to undertake inquiry-based learning in a systematic manner to improve natural sciences teaching in classrooms. From this point of view, inquiry-based teaching could be considered one of the most important methods for teaching the natural sciences because it focuses on real teaching and learning processes and encourages students to construct their own knowledge. Pedagogical mentoring and coaching practices to novice and veteran teachers was limited to ensure instructional practices and students' learning engagement in classrooms via plan-do-study-act-evaluation paths to ensure their competencies (Girma, 2023). This encourages

the teacher to play significant roles in linking the learner and process of learning. The teacher not only plans the inquiry but also plans how this inquiry can end in a meaningful experience that can be used in the future. Implementing is not always the best way to learn. The important thing to consider is what makes the students gain conceptual development.

Teachers' capabilities in organizing and facilitating inquiry-oriented teaching and learning processes are essential. The paradigm shift from lecture method to active learning methods is essential to make students take the position of constructivists through developing positive interdependence, self-confidence, communication and information processing skills and critical thinking because of higher order thinking and learning practices (Girma, 2022). This professional and pedagogical capability cover issues such as self-efficacy, motivation, and enthusiasm for teaching (Tschannen-Moran and Woolfolk Hoy, 2001). In relation to this, Shalem and Peddlebury (2010) depict that teachers are at the core of curriculum implementation, and their perceptions about inquiry-based teaching methods can provide pedagogical insights that can enhance learner motivation in sciences.

Teachers' perception about inquiry is a problem that relates to curriculum delivery, and its investigation can improve the quality of learning and hopefully stimulate learner interest in science. The rationale behind conducting the present study was to investigate the perception and performance of secondary education natural science teachers and their performance of inquiry-based teaching methods in secondary schools at Hawassa University Technology Village.

2 Research Problem

The 21st century classroom requires the 21st century teachers and students, and in that both teachers and students are equally important to implement the curriculum in Ethiopian classrooms (Girma, 2022). Now days, it is evident that inquiry-based teaching methods improve the quality of teaching and learning in the natural sciences. It is on this ground that teachers, particularly secondary school natural science teachers, need to have positive perceptions and be encouraged to apply inquiry-based teaching in secondary schools.

Regarding this, secondary school teachers' lack experiences using inquiry-based teaching methods (Ramnarain and Hlatshwayo, 2018). Likewise, a study conducted in Rwanda by Mugabo (2015) revealed that science teachers did not understand what inquiry-based science teaching methods meant and tended to associate inquiry-based teaching methods with teacher-dominated demonstrations, even though inquiry-based teaching methods are the official curriculum policy in that country. Teaching sciences, such as well-equipped laboratories, was perceived as a challenge that discouraged sciences subjects, particularly biology, chemistry, and physics. For instance, a study in South Africa by Ramnarain (2015) indicates that teachers' lack of pedagogical content knowledge and general pedagogical knowledge greatly contributed to their inability to teach through inquiry. This implies that some teachers had difficulties teaching science subjects in a practical way and, in so doing, de-motivated learners. Other studies revealed that the problem of the lack of resources

In the Ethiopian context, there are some studies conducted in different areas of the country concerning the advantages of the inquiry-based teaching method. For instance, the findings of a study conducted by Asrat and Mekonnen (2020) on the effect of using the guided inquiry teaching method in improving grade eight students' concept of photosynthesis in primary school in Ethiopia revealed that the guided inquiry teaching method

is more effective than the lecture method in improving students' conceptual understanding of photosynthesis. Also, the findings of the study conducted by Adugna (2017) depict that the teachers working in the target schools are aware of the importance of practical-based learning that promotes the acquisition of long-lasting knowledge and skills at the preparatory school level. However, the aforementioned researchers focused on the importance of the inquiry-based teaching method, and their investigation overlooked the teachers' perceptions and their performance regarding the inquiry-based teaching methods. Hence, this study differs from the others in that it focuses on investigating teachers' perceptions and performance concerning inquiry-based teaching methods in secondary school.

In addition, from the researchers teaching experiences and their observations, a number of gaps exist between theories and practices in relation to performing inquiry-based teaching methods in the natural sciences. Therefore, the researchers were motivated and inspired to examine science teachers' perception and performance of inquiry-based teaching methods in the secondary school of Hawassa University Technology Transfer Villages.

The study was aimed at investigating science teachers' perception and performance of inquiry-based teaching methods in secondary schools in Hawassa University technology transfer villages. The study helps to:

1. Examine science teachers' perception and utilization inquiry-based teaching methods in their instruction.
2. Evaluate the extent to which the science teachers are performing inquiry-based teaching methods.
3. Test statistically significance of differences across sciences teachers' performance of inquiry-based teaching methods.
4. To identify major challenges hinder teachers in their attempt to integrate inquiry-based teaching methods in science instruction.
5. Evaluate the professional and technical collaboration between school of teacher education in HU and secondary school science teachers to improve their competencies of practicing IBT methods.

2.1 Research questions

In line with the objective of the study, the following research questions were raised and answered. These are:

1. How do science teachers perceive and practice the use of inquiry-based teaching methods in the science instruction?
2. To what extents are teachers using inquiry-based teaching methods in their science teaching/learning?
3. Does the use of inquiry-based teaching methods shows a statistically significant differences between: (a) male and female teachers; and (b) among teachers of various disciplines?
4. What are the major challenges facing science teachers in their attempt to integrate inquiry-based teaching methods?
5. How well do secondary schools science teachers work in collaboration with college of teacher education to improve their pedagogical competencies of using IBT method?

2.2 Significance

The study helps secondary school natural science teachers to undertake self-assessments regarding their perception and performance of inquiry-based teaching in natural science classes. Therefore, the researchers' serves as a framework for curriculum designers and planners who might want to conduct further study on natural science teachers' perceptions and inquiry-based teaching of natural sciences in secondary schools.

3 Research Methodology

3.1 Research Design

In order to meet the main purpose of the study, a mixed method with embedded mixed (QUQN+qual) design were employed. An embedded mixed design was utilized to examine the current perception and practices of respondents on the issue under investigation in which the researchers collect data at one point in time (Creswell, 2014).

3.2 Sources of data

This study is limited to the investigation of science teachers' perception and the performance of inquiry-based teaching methods aligned to natural science education in secondary schools, and the researchers limited this study to five words. From Dore Bafeno (Hawassa Langano High School), Yirgalem town (Yirgalem High School), Boricha (Yorba High School), Wondo Genet (Wondo Genet Secondary School), and Habela Lida (Habela High School) of Hawassa University Technology Transfer Villages. Therefore, the primary sources of data were secondary school principals, heads of departments of natural sciences, and natural science teachers from sampled government secondary schools in the study area.

3.3 Sample and sampling technique

There are 7 administrative town woredas and 30 woredas in Sidama Regional State. Since the size of the population is large, all the woredas and their respective secondary schools were not included in the study. Only five Woredas, which are found in Hawassa University Technology Villages, were selected using the availability sampling technique. The target secondary schools were selected using purposive sampling technique, that one school from each woreda to obtain adequate information about the technology villages. The sample size of participants was determined based on Cohen et al. (2018) sample size, confidence level, and confidence interval for the random sample table; 135 teachers (at 95% confidence level) out of the total population of 204 teachers from five secondary schools using stratified sampling technique followed by simple random sampling technique to select from each stratum.

In addition, while undertaking interview, 5 school principals and 5 head department heads of natural sciences were selected from sample secondary schools (one from each) using availability and purposive sampling techniques respectively. Overall, 145 participants; 135 respondents for a questionnaire and 10 informants for an interview were included in this study for triangulation and enrichment of data (Cohen et al., 2018). The distribution of population, sample size and sampling techniques is illustrated in Table 1 below:

Table 1: Total Population, sample size, and sampling techniques

Study subjects	Department Head		Natural Science Teachers		Principals	
	Sample	%	Population	Sample	%	Population
Hawassa Langano	3	1	33	38	25	66
Yirgalem	3	1	33	65	43	66
Yorba	3	1	33	28	18	64
Wondo Genet	3	1	33	42	28	66
Habela	3	1	33	31	21	67
Total	**15**	**5**	**204**	**135**	**55**	

3.4 Data collection instruments

Using multiple data collection instruments (Creswell and David, 2018), relevant data for the study was collected from the study subjects in the study area. Evidence helps provide answers to the research questions or hypotheses (Creswell, 2014). To this end, to answer the research questions, both quantitative and qualitative data were collected using a questionnaire, an interview, and observation.

For the questionnaire, questions that are related to science teachers' perception of the use of inquiry-based teaching methods, extent of science teachers' performance of inquiry-based teaching methods, and major challenges that science teachers are facing when integrating inquiry-based teaching methods were developed by the researchers from an extensive review of various literature and previous studies. The types of questions included were more closed-ended items and some open-ended questions. Accordingly, the format for items is based on a Likert scale. The Likert scale for teachers perceptions of the use of inquiry-based teaching methods is valued as strongly agree (5), agree (4), undecided (3), disagree (2), and strongly disagree (1); for teachers performance on the inquiry-based teaching methods, it is valued as always (5), usually (4), sometimes (3), rarely (2), and never (1). Likewise, the challenges facing teachers range from 1 (the least challenging), 2 (more challenging), and 3 (most challenging). The questionnaire was structured into two main parts.

Concerning the interview guide, a semi-structured interview guide was used to obtain in-depth and detailed information from the participants (Yin, 2018). The interview was held with school principals and natural science department heads. The major themes of the interview guide natural science teachers' perceptions and the performance of inquiry-based teaching methods in natural science education. The interview was conducted in Amharic to make it easy for interviewees to understand, and then the data was transcribed into English.

Moreover, each sampled secondary school's laboratories (Biology, Chemistry, and Physics) were critically observed. The observation was conducted in each sampled school's laboratories by preparing the details of the observation checklist that enable researchers to describe whether the labs were functional and the availability of chemicals for science instruction through IBT methods.

3.5 Procedure of data collection

Regarding the data collection procedure, before collecting the data, the researchers explain the purpose of the research to the school principals. After permission is secured, the researchers and the principal of the selected secondary schools arrange the time and place to get the participants. Participants were informed about the objective of the study

and asked to participate as scheduled. In the first phase, quantitative data gathering was conducted. Accordingly, the required data was collected through the prepared questionnaire to obtain the necessary information. While quantitative data was collected, qualitative data was gathered to triangulate findings from quantitative data sources, which were conducted through semistructured interviews and observation (Cohen et al., 2018). Therefore, the required data was collected step by step through prepared semistructured interview guides and observation checklists. As the interview guide is semistructured, other important questions were generated during the interview, and leading questions were introduced ahead. Observations were made according to the checklists prepared.

3.6 Validity and reliability

After preparing instruments for data collection, validation of the instruments was done using expert review on contents, face, and formats. Here, some irrelevant items were discarded, and some of the items were modified as per the comments given by experts. Then, the issue of reliability was addressed by pilot testing of the instruments on 30 teachers in a non-sample secondary school, which was not part of the main study. To meet this, the researchers calculated Cronbach's alpha coefficient (α) to measure the internal consistency of questionnaires since it is applicable to test a coefficient of inter-item correlation of Likert scale items. Accordingly, the results of the study found out that $\alpha_1 = .78$ for the scale to measure teachers perception of the use of inquiry-based teaching methods, $\alpha_2 = .80$ for the prepared scale to measure teachers performance of inquiry-based teaching methods, and $\alpha_3 = .76$ for the prepared scale to measure challenges to implementing inquiry-based teaching methods. Finally, with the average value of alpha coefficient (α) 78 found above the expected measure to be possibly utilized, as Muijs (2004) evidenced, a coefficient of $\alpha.70$ and above is internally consistent (acceptable) for the purpose of the study.

3.7 Method of data analyses

Based on the nature of the data gathered, both quantitative and qualitative methods of data analysis were applied using SPSS-26 and NVivo-14 software respectively. Quantitative data gathered using a questionnaire was analyzed using both descriptive and inferential statistics using software. Descriptive statistics such as frequencies, percentages, means, and standard deviations were computed. Besides, inferential statistics from an independent sample T-test were made to compare the means of two groups of male and female teachers on their performances in inquiry-based teaching methods. Similarly, to examine whether there is (a) a significant difference among teachers of various disciplines as well as (b) a difference among teachers of various disciplines on the extent of their performance of inquiry-based teaching methods, a one-way ANOVA was computed. With regard to qualitative data that was gathered using interview and open-ended questions and observation checklist content analysis in narration form under their main themes, Interview and observation data were mainly used for triangulation, with quantitative data gathered using questionnaires, which helps confirm its reliability.

3.8 Ethical practices

Ethical approval for this study was obtained from College of Education to avoid the research misconduct because harm is narrated in the context of institutional characteristics, policies, procedures, guidelines and work environment (Petousi and Sifaki, 2020). Before distributing the instruments to the participants for data collection, permission was sought from education administration offices and secondary school participants

4 Results and discussion

In this part, the researchers report the general characteristics of the respondents and the major findings of the study based on the evidences. Data collected using different instruments from multiple sources was presented according to the main research questions of the study. Questionnaire was employed for teachers. From the total of 135 questionnaires administered to teachers, 132 were properly filled out and returned, providing a 97.7% response rate. For triangulation, an interview was made with total of 10 principals and science department heads. In addition, observation was held in the school laboratory.

4.1 General characteristics of respondents

Table 2: Participants number by school, sex, and educational background

Variables	Category	F	%
School	Hawassa Langano	24	18.2
	Yirgalem	39	29.5
	Yirba	16	12.1
	Wondo Genet	33	25
	Habela Lida	20	15.2
	Total	132	
Sex	Male	79	59.8
	Female	53	40.2
	Total	132	
Academic qualification	College Diploma	11	8.3
	Bachelor's Degree	112	84.8
	Master's Degree	9	6.8
	Total	132	

As it is shown in Table 2, of the 132 teachers who participated in the study, the highest were Yirgalem and Mondo Genet 39 (29.5%) respectively, and the lowest was Yirba 16 (12.1%). Regarding the sex composition, the proportion of male teachers outnumbered female teachers: 79 (59.8%) males and 53 (40.2%) females. The data shows that there were a low proportion of female teachers in selected secondary schools, which contrasts with the Education Sector Development Program IV (Ministry of Education, 2010).

Concerning the academic qualifications, 112 (84.8%) were Bachelor's Degree holders, 11 (8.3%) were College Diploma holders, and the remaining 9 (6.8%) were Master's Degree holders. As per MoE policy, teachers of secondary schools are expected to have at least a first degree to teach in Ethiopian secondary schools (Ministry of Civil Service, 2011). Thus, having qualified with the first degree of the majority of the participants in the level of education contributes to corresponding resemblances in positive perceptions and the performance of inquiry-based teaching methods in teaching natural science subjects.

Table 3: Participants services in year and subject teach

Variable	Category	F	%
Services in Year	1-5	28	21.2
	6-10	60	45.5
	11-15	35	26.5
	16-20	7	5.3
	21 & above	2	1.5
Subject teach	Biology	31	23.5
	Mathematics	33	25
	Chemistry	29	22
	Sport	14	10.6
	Physics	25	18.9

Table 3 illustrates that based on their experiences in teaching; teachers have been grouped into five. Thus, 28 (21.2%) have below five years of teaching experience, 60 (45.5%) have between 6 and 10 years, 35 (26.5%) have between 11 and 15, 7 (5.3%) have between 16 and 20, and the remaining 2 (1.5%) have greater than 20 years of teaching experience. This can show that a considerable number of teachers have teaching experiences that would help them implement inquiry-based teaching methods. Moreover, of the participating teachers, 33 (25%) were in mathematics, followed by 31 (23.5%), 29 (22%), 25 (18.9%), and 14 (10.6%) in biology, chemistry, physics, and sport, respectively.

4.2 Science teachers' perception of the use of IBT methods

Teachers' perception and views on the use of inquiry-based teaching methods have had a profound effect on their performances when using these methods in teaching natural science teachers to describe their perception using a subjects. Accordingly, items related to Likert scale ranging from 1 (strongly disagree) assumptions about inquiry-based teaching to 5 (strongly agree). methods and their advantages were presented for

Table 4: Frequency and Means of Teachers' Perception of Inquiry-Based Teaching Methods ($n = 132$)

No.	Items of Teachers' Perceptions of IBTM	Mean	SD
1	Inquiry-based methods help learners develop experimental skills.	4.32	0.68
2	Feel confident when students perform practical work collaboratively.	4.33	0.72
3	Prefer learners to design their own inquiries.	3.55	0.85
4	IBTM encourages active participation of students.	4.17	0.73
5	IBTM encourages creativity and innovative ideas of students.	4.08	0.76
6	IBTM imparts problem-solving skills and higher-order thinking.	4.18	0.78
7	Inquiry activities facilitate group work in natural science.	3.80	0.90
8	IBTM is a learner-centered strategy where learners construct knowledge.	3.86	0.84
9	Students learn best when given opportunities to explore problems.	3.92	0.83
10	IBTM enhances conceptualization and contextualization of science content.	3.58	0.79
11	Secondary schools are motivated to collaborate with HU School of Teacher Education.	3.29	0.57
	Grand Mean	**3.97**	–

Note. Scale: < 1.49 Strongly Disagree; 1.50–2.49 Disagree; 2.50–3.49 Undecided; 3.50–4.49 Agree; > 4.50 Strongly Agree.

Source: Field survey, 2023

1.5-2.49 Disagree, 2.5-3.49 Undecided, 3.5-4.49 Agree, > 4.5 strongly Agree

As shown in Table **??**, the mean scores of teachers' responses for items 1 and 2 were (M = 4.32, SD = .68 and (M = 4.33, SD = .72) respectively. They agreed that IBT methods help learners develop experimental skills and feel confident when they perform practical work collaboratively in natural science subjects.

Besides, the mean score of the respondents for item number 3 was (M = 3.55, SD = .85), which shows that the respondents agreed that they prefer learners to design their own inquiries. Likewise, the participants mean scores for items 4 and 5 were (M = 4.17, SD = .73) and (M = 4.08, SD.76), respectively. This infers that the participants agreed that the use of IBT methods encourages active participation, creativity, and innovative ideas among students in natural science subject learning.

Moreover, the participants mean scores for items 6, 7 and 8 were (M = 4.18, SD = .78), (M = 3.80, SD = .90) and (M = 3.86, SD = .84) respectively. This revealed that the participants agreed that the use of IBT methods imparts problem-solving skills in learners and higher-order thinking in natural science subjects, facilitates students working in groups, and makes students construct knowledge under the guidance of teachers.

Furthermore, the participants mean scores for items 9 and 10 were found to be (M = 3.92, SD = .83) and (M = 3.53, SD = .79) respectively. This indicates that the teachers agreed on the perception that IBT methods make students learn best when they get opportunities to explore problems and enhance their conceptualization of contents in science.

As it could be understood from the above computed mean values, the grand mean (GM = 3.79) shows that teachers have a positive perception of the use of IBT methods in teaching natural science subjects. Across all items, teachers have a similar level of agreement on their perception of IBT methods. The interview results also align with the survey response, reporting that teachers have positive perceptions of the use of IBT methods in teaching natural science subjects. For instance, one of the mathematics department heads replied that:

"I believe that inquiry-based teaching methods facilitate teachers' ability to impart problem-solving skills to learners through higher-order thinking activities, which contribute to students' deep understanding of concepts in science subjects. Our teachers developed positive attitudes towards using IBT methods in the teaching and learning of natural science subjects" (DH2, April 2023).

Furthermore, one of the interviewee suggested that

"The secondary schools are expected to work in collaboration with school of teacher education pertaining to active learning, continuous assessment, classroom management, and action researches. However, as technology transfer village school, my school is not supported both technologically, professionally and technically (DHL3, April 2023).

The results of this study is consistent with those obtained from previous studies (Ruzaman, 2020), which explained that teachers need to have a constructive perspective through the proper use of inquiry-based learning and that learners are expected to construct their knowledge under the guidance of the teacher.

4.3 Science teachers' performing of the use of IBT methods

Teachers' effective practices of IBT methods during the teaching and learning of natural sciences subjects are paramount in the 21st century, which allow teachers to collaborate

with students in their constructing knowledge, solving problems, and understanding the concepts of science. In view of this, to describe the extent to which natural science teachers perform IBT methods during their instruction, teachers were asked to provide their responses using a questionnaire designed on a Likert scale ranging from 1 (never) to 5 (always) perform.

Table 5: Frequency of Teachers' Performance in Integrating IBT Methods ($n = 132$)

No.	Items of Teachers' Performance of IBTM	Mean	SD
1	Prepare and show practical demonstrations for students.	2.62	0.69
2	Allow students to perform hands-on and minds-on practical activities.	2.95	0.80
3	Encourage student participation in discussion and argument.	2.84	0.81
4	Prompt students to propose solutions for practical problems.	2.99	0.80
5	Ensure students actively participate in inquiry-based learning.	2.28	0.75
6	Provide laboratory practices, projects, and assignments.	1.93	0.73
7	Follow safety precautions and test practical work prior to lessons.	2.78	0.80
8	Provide clear instructional guidelines for practical activities.	2.74	0.79
9	Direct learners to analyze and synthesize experimental data.	2.17	0.67
10	Facilitate learning through collaborative and independent problem-solving.	2.47	0.75
11	Collaborate with the School of Teacher Education to improve pedagogical skills.	2.39	0.68
	Grand Mean	**2.57**	–

Note. Scale: < 1.49 Never; 1.50–2.49 Rarely; 2.50–3.49 Sometimes; 3.50–4.49 Often; 4.50–5.00 Always.

Source: Field survey, 2023
Scale of Interpretation: Never $<$ 1.49, Rarely = 1.5-2.49, Sometimes = 2.5-3.49, Often = 3.5-4.49, Always = 4.5-5.0

As indicated in the above Table **??** for items 1 and 2, the mean scores of the teachers' responses were = 2.62, SD = .69 and M = 2.9, SD = .80) respectively. This is evident from the fact that they sometimes prepare and show practical demonstrations for students and allow them to perform hands-on and mind-on practical activities in science teaching. Likewise, the mean scores of teachers for items 3 and 4 were M = 2.84, SD = .81 and M = 2.99, SD = .80) respectively. This indicates science teachers sometimes encourage students' participation in discussion and argument in learning and make students propose solutions for practical problems.

Yet, as it is clearly indicated from items 5 and 6, the mean values of teachers responses were M = 2.28, SD = .75 and M = 1.93, SD = .73) respectively. This is evident from the fact that sciences teachers rarely make students actively participate in inquiry-based learning and provide students with laboratory practices, projects, and assignments to improve their learning potential.

Again, the mean scores for item 7 and 8 teachers responses were M = 2.78, SD = .80 and M = 2.74, SD = .79 respectively. This shows that teachers sometimes follow safety measures and try the practical work them when preparing for the lesson and give learners a guideline with clear instructions they follow while they are doing practical activities.

However, from items 9 and 10, the mean scores of the teachers' responses were = 2.17, SD = .67 and M = 2.47, SD = .75 respectively. This reveals that natural science teachers rarely make learners analyze and synthesize experimental data and make students learn by finding solutions to problems through working collaboratively and independently. Therefore, the aggregated grand mean value (GM = 2.57) of teachers' responses to performing IBT methods in the teaching and learning process of natural science falls in the range of "sometimes". Across most items, teachers reported a similar level of frequency.

However, the results of interviews with school principals and department heads differ from the survey responses from teachers, who informed us that teachers rarely integrate IBT methods in their teaching and learning of natural science. For example, one of the school principals reported that:

"In my school, teachers are unable to implement IBT methods in the teaching and learning of natural sciences because of different reasons. To mention some of them: large class size, lack of teachers' skill to integrate IBT methods, absence of lab and chemicals, etc." (SP2, April 2023).

In addition to this, one of the chemistry department heads added that:

"Frankly speaking, in our school, teachers hardly utilize IBT methods during instruction of natural science subjects. They simply use the tradition of teacher-centered teaching methods during teaching and learning of natural science subjects the same to other subjects' (DH3, April 2023).

The findings are in agreement with the findings of the previous study by Zafu and Wudu (2018), who described that the majority of teachers had awareness of IBTM; they believed that IBTM was useful for students learning but did not use it in their classroom instruction.

4.4 Comparison between male and female and teacher of various disciplines

In this section, comparisons between male and female teachers' and teachers teaching different subjects were examined on their performance of IBT methods.

4.4.1 Comparison between male and female teachers

The significance differences among secondary school teachers were checked using the independent variable sex, and the result given is illustrated in Table 6 below.

Table 6: Group Statistics on integration of IBT methods by sex

Dependent Variable	Sex	N	Mean	Std. Deviation	Std. Error of the mean
Teachers performing of IBT methods	Male	72	2.64	.336	.037
	Female	52	2.53	.313	.043

Source: ANOVA output

As presented in Table 6, the mean and standard deviations of the scores on the IBT method of the two groups revealed that the integration of IBT method score of male teachers is (M = 2.64) and the standard deviation is (SD = .336). In the same way, the integration of IBT methods score of female teachers is (M = 2.53), and the standard deviation is (SD = .313).

The results of Leven's test for equality of variance and the 95% confidence interval were computed, and the obtained result is presented in Table 7 below.

Table 7: Independent Sample T-test between male and female teachers

Sex	N	Mean	SD	Std. Error Mean	t	p-value
Male	79	2.64	0.336	0.037	1.831	0.069*
Female	53	2.53	0.313	0.043		

Note. Equal variances assumed ($F = 0.044, p = 0.835$). Mean difference = 0.10654, 95% CI $[-0.008, 0.221]$. *Difference is not statistically significant ($p > .05$).

Source: ANOVA output

* = there is no significant difference, p > .05

The Levene's test for equality of variances in Table 7 illustrated that the variances are not equal since the p value of .835 is not statistically significant. The implication is that the first row's equal variance assumed value was utilized. The difference between integration of IBT method scores for male teachers (M = 2.64, SD = .336) and for female teachers (M = 2.53, SD = .313) is .106. The 95% confidence level for this difference is .008-221. Since, this confidence interval include 106, there is no statistically significant difference at the two-tailed 5% level. This infers that female teachers are similar to their respective male teachers in their performance of IBT methods in secondary schools.

4.4.2 Comparison within teachers teaching different science subjects

To examine whether there are significant differences between teachers teaching different subjects on the implementation of IBT methods, a one-way ANOVA was computed, and the result is presented in the following Table 8 below:

Table 8: ANOVA Summary of differences on the integration of IBT methods among teachers

Sources of Variation	Sum of Squares	df	Mean Square	F	Sig. (p)
Between Groups	0.857	4	0.214	2.021	0.095*
Within Groups	13.472	127	0.106		
Total	**14.329**	**131**			

Note. *Not statistically significant at $p > .05$.

Source: ANOVA output * = there is no significant difference, p > .05

As illustrated in Table 8, the probability of the F-ratio is .095. Since this value is greater than the critical p value of .05, There was no a statistically significant difference. Because the mean scores of teachers teaching different subjects using IBT methods are similar. This infers that there is no statistically significant difference among teachers of different subjects on the practice of IBT methods in their instruction of sciences.

4.5 Major challenges those hinder teachers to integrate iBT methods

In the course of teaching and learning natural science subjects, there are challenges raised by teachers, school principals, and other educational experts that impede teachers from integrating IBT methods into natural science instruction. Teachers questionnaires were presented using a three-level Likert scale ranging from 1 (least challenging) to 3 (most challenging). In addition, qualitative data were gathered using open-ended questions for teachers, interviews with the principal as well as the department head, and observation of the secondary school lab. The results are presented in Table 9, ordered from most challenging to least challenging.

Table 9: Major challenges to teachers in the integration of IBT methods (n=132)

No.	Possible Challenges	Mean	SD
1	Lack of instructional materials	2.81	0.43
2	Absence of laboratory equipment, chemicals, and manuals	2.70	0.47
3	Large class size	2.66	0.55
4	Lack of creativity and innovation among teachers	2.62	0.53
5	Dominance of traditional lecture methods over IBTM	2.61	0.54
6	Lack of teachers' competencies in implementing IBTM	2.59	0.61
7	Lack of technical/professional support from school principals	2.10	0.64
8	Ineffective cooperation/interaction among teaching staff	1.69	0.68
9	Shortage of instructional time	1.37	0.51

Note. Scale: < 1.49 Least challenging; 1.50–2.49 Moderately challenging; 2.50–3.00 Most challenging.

Source: Field survey, 2023 Scale of Interpretation $<$ 1.49 Least challenging, = 1.5-2.49 Moderate challenging, and 2.5-3.0 Most challenging.

As shown in Table 9, the major barriers to teachers integrating IBT methods were lack of instructional materials, absence of laboratory equipment, chemicals, and manuals, large class size, lack of creativity and innovation among teachers, dominance of traditional lecture method over inquiry-based teaching methods, and lack of teachers' competence in implementing inquiry-based teaching methods.

Besides, using an open-ended question, teachers were asked to add if there were other major challenges to performing IBT methods. Most of the respondents pinpointed the lack of students' interest and motivation, the amount of content expected to be covered, and the lack of instructional resources.

Secondary school principals and department heads were interviewed about the major challenges that affect the integration of IBT methods in their schools. The results extracted from the interview transcripts were analyzed to substantiate the quantitative data gathered from teachers. Secondary school principals reported that a lack of instructional materials was one of the major challenges hindering teachers' practice of IBT methods. For example, one school principal reported that:

"Lack of instructional equipment, particularly for biology, chemistry, physics, and sports, is a challenge. The absence of laboratory chemicals and equipment affected teachers and students' ability to actually practice performance-based activities in their instruction of natural science subjects" (SP2, April 2023).

In addition to this, one of the physics department heads added that:

"Lack of laboratory equipment and skilled technicians, lack of instructional media and technologies, and limited school facilities are the big challenges for secondary school teachers to perform IBT methods and make students do practical activities in natural science subjects" (DH5, April 2023).

Besides this, the results of observation show that most of the school labs observed lack lab equipment's, trained technicians, and chemicals for science teaching and learning in relation to this Trautmann et al. (2010) indicate that teachers doubt their ability to engage in inquiry learning in classroom practices. Likewise, Ramnarain (2016) established that the absence of professional training and insufficient resources negatively affected proper implementation of IBL. This finding is in line with the findings of Girma (2023) which suggested that collegiality is essential in teachers' professional competency development because teachers make communication and interactions in small groups at the department level when supported with mentoring and coaching practices

5 Conclusions

Based on the findings of the study, the following conclusions were drawn in light of the basic research questions: The use of IBT methods is paramount in the teaching and learning of natural science subjects. Interestingly, inquiry-based learning seemed to be effective for the acquisition of practical skills and the development of higher-order thinking skills in students. The findings of the study revealed that natural science teachers have a positive perception of the use of IBT methods in the target secondary schools. These help teachers to be motivated to implement IBT methods. The findings of the study also show that natural science teachers rarely perform IBT methods in their instruction of natural science subjects; the results of the T-test and one-way ANOVA revealed that there is a statistically significant difference between teachers because of sex and teaching different subjects. From this, it is concluded that teachers' quality teaching and

learning could not be achieved without regular use of IBT methods in natural science subjects. Thus, it was concluded that in-service training would be given to teachers to equip them with the necessary skills for implementing IBT methods.

6 Recommendations

In line with the major findings obtained and conclusions reached, the following recommendations were forwarded for the betterment of IBT methods in secondary schools in Hawassa University technology transfer villages.

1. Secondary school science teachers should integrate IBT methods regularly to provide quality instruction for the students.
2. Secondary school science teachers should collaborate and share experiences on the practical integration of IBT methods into natural science instruction.
3. Hawassa University's College of Education should provide in-service training for teachers to enhance their use of IBT methods in natural science instruction.
4. Sidama Educational Bureau, Hawassa University school of teacher education, and support secondary schools in applying IBT methods by providing instructional materials like laboratory equipment and chemicals.
5. Principals and supervisors should work on teachers' capacity building practices of using inquiry based teaching methods in classrooms.
6. Policymakers, student textbook writers' secondary school administrators, and teachers themselves should advocate IBT methods that develop students' scientific reasoning, problem solving, and creative skills.

7 Limitations and further research

This study has not accomplished without limitations and the researchers tried to provide clear picture through making proper analysis of the different variables associated with implementation of IBT method in secondary school it requires further interventions through design based study lesson studies.

Acknowledgments

The researchers acknowledge the primary sources of data for the willingness they have shown while providing responses during the preliminary and main studies. We acknowledge Hawassa University for financial coverage while conducting this research.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for profit sectors.

Data Availability

Data can be made available on the behavior of the request

Declaration of interests' statement

The author declare no competing interests.

References

Adugna, A. (2017). Practical-based learning in preparatory schools.

Anderson, R. D. (2002). Reforming science as inquiry: What research says about inquiry? *Journal of Science Teacher Education*, *13*(1), 1–12.

Asrat, D., & Mekonnen, D. (2020). Effect of using guided inquiry teaching method in improving grade eight students' concept of photosynthesis, primary school: Ethiopia. *International Journal of Innovative Research in Education*, *7*(1), 01–16.

Chen, Y., Mineweaser, L., Accetta, D., & Noonan, D. (2018). Connecting argumentation to 5e inquiry for pre-service teachers. *Journal of College Science Teaching*, *47*(1), 22–28.

Cohen, L., Manion, L., & Morrison, K. (2018). *Research methods in education* (8th ed.). Routledge.

Creswell, J. W. (2014). *Research design: Qualitative and mixed approaches* (4th ed.). Sage Publication.

Creswell, J. W., & David, C. J. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications, Inc.

Dillon, J. T. (2009). The questions of curriculum. *Journal of Curriculum Studies*, *41*(3), 343–359.

Girma, M. G. (2022). The effects of teachers' professional and pedagogical competencies on implementing cooperative learning and enhancing students' learning engagement and outcomes in science: Practices and changes. *Cogent Education*, *9*(1), 1–22.

Girma, M. G. (2023). The effects of pedagogical mentoring and coaching on primary school teachers' professional development practices and students' learning engagements in classrooms in oromia regional state: Implications for professionalism. *Education 3-13, International Journal of Primary, Elementary and Early Years Education*, *51*(8).

Gudyanga, R., & Jita, L. C. (2019). Teachers' implementation of laboratory practical in the south african physical sciences curriculum. *Issues in Educational Research*, *29*(3), 715–731.

Keller, M. M., Neumann, K., & Fischer, H. E. (2016). The impact of physics teachers' pedagogical content knowledge and motivation on students' achievement and interest. *Journal of Research in Science Teaching*, *54*, 586–614.

Ministry of Civil Service. (2011). *Teachers' career structures and salary scale revision study report* (tech. rep.). MoCS. Addis Ababa.

Ministry of Education. (2010). *Education sector development program iv* (tech. rep.). MoE. Addis Ababa.

Mugabo, R. L. (2015). Science teachers' understanding of inquiry-based science teaching (ibst): Case of rwandan lower secondary school science teachers. *Rwandan Journal of Education*, *3*(1), 77–90.

Muijs, D. (2004). *Doing quantitative research in education with spss*. SAGE Publications Ltd.

Petousi, V., & Sifaki, E. (2020). Contextualizing harm in the framework of research misconduct: Findings from a discourse analysis of scientific publications. *International Journal of Sustainable Development*, *23*(3/4), 149–174.

Ramnarain, U. (2015). Understanding the influence of intrinsic and extrinsic factors on inquiry-based science education at township schools in south africa. *Journal of Research in Science Teaching*, *53*(4), 598–669.

Ramnarain, U. (2016). Understanding the influence of intrinsic and extrinsic factors on inquiry-based science education at township schools in south africa. *Journal of Research in Science Teaching*, *53*(4), 598–619.

Ramnarain, U., & Hlatshwayo, M. (2018). Teacher beliefs and attitudes about inquiry-based learning in a rural school district in south africa. *South African Journal of Education*, *38*(1), 1–10.

Ruzaman, N. (2020). Inquiry-based education: Innovation in participatory inquiry paradigm. *International Journal of Emerging Technologies in Learning (iJET)*, *15*(10), 4–15.

Shalem, Y., & Peddlebury, R. (2010). Shaping curriculum implementation.

Trautmann, N., MaKinster, J., & Avery, L. (2010). What makes inquiry so hard? (and why is it worth it?)

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing an elusive construct. *Teaching and Teacher Education*, *17*(7), 783–805.

Windschitl, M. (2002). Framing constructivism in practice as the negotiation of dilemmas: An analysis of the conceptual, pedagogical, cultural, and political challenges facing teachers. *Review of Educational Research*, *72*(2), 131–175.

Yin, R. K. (2018). *Case study research: Design and methods* (5th ed.). Sage.

Zafu, A., & Wudu, T. (2018). Teachers' awareness and practice of inquiry-based teaching methods.

Zoller, U. (2011). Science and technology education in the stes context: A paradigm shift.

Policies and Reviewer Guidelines

Reviewers' Guideline

1. Criteria for Preliminary Evaluation

In evaluating the manuscript, please note the following points:

1. Write your comments and/or suggestions in detail based on each criterion outlined below; and
2. Use each criterion given below only when it is applicable and relevant. Whenever you think a criterion is not applicable, please, indicate this clearly:

1. Does the manuscript have relevant contents within the scope of Social Sciences and Education?
2. Does the title fully reflect the content of the manuscript?
3. Does the manuscript fit the word limit stated in the EJES guideline?
4. Did the author/s apply the manuscript style and format as stated in EJES guideline?
5. Are the data collection methods and instruments reliable?
6. Do the methods adequately described?
7. Does the data properly and clearly analyzed?
8. Do the findings justify the conclusion and the recommendations (if there is any) drown by the author (s)?
9. What is your recommendation, as a reviewer, in sending this manuscript for peer-reviewers:
10. It can be sent as it is? _____
11. It can be sent with revision/reorganization? (please suggest comments); _____
12. Not at all? It should be rejected

B..Reviewers' Guideline

1. Does the title reflect the content thereof? Is it concise and clear?
2. Is the abstract written properly having core elements of an abstract in reflecting aspects of the study?
3. Is the content of the study significant and worthy of investigation to addresses theoretical and/or practical values? How do you assess the originality of the manuscript?

4. Does/do the author/s employed sound and valid research methods? Sampling techniques and methods of data collections used?
5. Is the literature used on the subject is adequate and relevant to the study theme?
6. Were the data analyzed objectively and clearly? Did the data support the findings?
7. Relevance, appropriateness and sufficiency of the references used?
8. What is your **recommendation** regarding the acceptance of this manuscript for publication?

1. Accepted as it is
2. Accepted with minor improvements
3. Accepted with major improvements
4. Reject

1. If the manuscript needs minor or major improvements, state the required points for its improvement.

.....
.....

Date:.....**Signature**: **.....**