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FACTORS AFFECTING IMPLEMENTATION OF ACTIVE LEARNING APPROACH IN MATHEMATICS EDUCATION AT SECONDARY SCHOOLS OF WAGHIMRA ZONE, AMHARA REGION, ETHIOPIA

HENOK, NEGASH

BAHIR DAR UNIVERSITY COLLEGE OF SCIENCE,

DEPARTMENT OF MATHEMATICS

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HENOK NEGASH GEBREMIKAEL

ADVISOR: TADELE EJIGU (PhD)

A thesis submitted to the department of mathematics, in Partial fulfillment of the requirement for Master of Science in mathematics

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APPROVAL PAGE

This is to certify that this thesis prepared by Henok Negash entitled “factors affecting implementation of active learning approach in mathematics education at secondary schools of waghimra zone, Amhara region, Ethiopia” and submitted in partial fulfillment of the requirements for the degree of master of science in mathematics complies with in regulation of the university and meets the accepted standard with respect to originality and quality

Approved by Board of Examiners

Internal Examiner's Name ----------Signature ----------Date ----------

External Examiner's Name----------Signature ----------Date----------

Chairperson’s Name----------signature----------Date----------

DECLARATION

I hereby declared that this thesis is submitted in partial fulfillment of the requirements for degree of Master of Science in mathematics and original research work carried out by me under the guidance and supervision of Dr.Tadele Ejigu, department of mathematics Bahirdar University. To the best of my knowledge no part of this thesis has been submitted to any other university or institute for award of any degree or diploma.

Advisor's Name----------Signature ---------- Date ----------

Name: Henok Negash G/Mikael Signature---------- Date----------

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Acronym

MOE	Ministry of Education
TESO	Teacher Education System Overhaul
NCTM	National Council of Teachers of Mathematics
STM	Science, Technology and Mathematics
STEM	Science, Technology, Engineering and Mathematics
AL	Active learning

Abstract

The purpose of this study was to explore factors affecting implementation of active learning approaches including attitudes of practitioners and the implementation of these approaches in mathematics education. A study was carried out through both qualitative and quantitative approach. It was conducted in Sekota and Wagsyum Admasu general secondary schools. The data were collected from 1300 student's sampled 93 students and all 18 mathematics teachers of these selected schools. In the selection of the sample population Purposive and simple random sampling were used. The main instruments of data collection were questionnaire, observation and interview. The data were analyzed using percentage, mean and frequency distribution table. This was complemented by a qualitative approach that used observation checklists and interviews for data gathering: 8 lessons were observed while the teachers taught their mathematics classes (two teachers from each of 2 sample schools were twice observed). In addition, semi-structured interviews were conducted with 2 mathematics department heads and 4 of the observed teachers. The findings of the study revealed that the main implementers of active learning (teachers and students) have positive attitude towards active learning approach. In spite of their good attitude, their practices of active learning were low, teachers' and students' tendency towards traditional method, lack of teachers' commitment as much as possible to implement by using available resource and their knowledge, shortage of time, lack of instructional material and large class size were the major ones. Improvement is needed for school situations, providing classroom and make number of learners standard per class, teachers should be committed to conduct AL as much as possible and provide training which support teaching and learning activity in school were recommended.

CHAPTER ONE

1. Introduction

1.1. Background

Mathematics is the study of number, construction, space, science of calculation, science of measurement and changes and so on. It is one of the oldest and most fundamental sciences. In the rapidly changing world in the development of science and technology, knowledge of mathematics plays a vital role for human binges daily life activity. In addition to this, to understand the computerized world and match with the newly developing information technology knowledge in mathematics is critical(Submitted et al., 2007).

Every mathematical problem poses an intellectual challenge and is a unique mental exercise. Mathematics has a wide range of applications in various field of science like business technology, physical science, medical science and industries. It has also application in art and social science fields (Price, 1971). The study of mathematics was established to produce an inspired to learn mathematics when compared to competent person who is able to apply knowledge of mathematics in everyday life effectively and responsibly in solving problems and making decisions(Journal & Sciences, 2015).

Mathematics is a subject of great educational values and makes a major contribution in achieving the aims of education. Hence, in our education system the place of mathematics as a subject is very important. It has got many educational values which determine the need of teaching the subject in schools. Mathematics education is also defined as means of practice on teaching and learning mathematics, along with associated scholarly research. The subject is taught for the development of power rather than knowledge. Thus, to achieve all above mentioned importance during teaching learning processes of mathematics the teacher should create active learning environment rather than lecturing. Because the key advantages of active learning include encouraging effective participation; involve collaborative activities and the development of communicative skills; build on prior knowledge; encourage critical reflection; challenge previous assumptions; adopt new perspectives; are open to diverse learning outcomes, and support individual responsibility for learning(B. Alemu & Schulze, 2012).

Active learning does not have a single definition, but it can be understood as practices that require students to be participating agents in the learning process, and not receptacles that record or absorb information transmitted to them by the teacher (Bonwell & Eison, 1990). Nardos (2000) has also pointed out that, in active learning the learners have obvious degree of freedom and control over the organization of the learning activities. It refers to classroom practices that engage students in activities, such as reading, writing, discussion, or problem solving, that promote higher-order thinking(Symposium, 2016). Active learning demands not only teachers to be experts in their fields but also they have to understand how students learn best(Case, 2012). Although, as stated above there is not a unique definition of AL, either in popular use or in the research literature, and all existing definitions are inherently vague. Any ways in active classrooms, emphasis is placed on engaging students and developing their high order cognitive faculties.

Therefore, active learning requires student-center approach with shift in stress from passive to active learning; a change in behavior supported by a change in thinking and encouraging students to take responsibility for their individual learning. Hence the intention of active learning method is to cultivate higher order level of knowledge, such as comprehension, application, critical thinking, analytical skills and evaluation.

In the curriculum of Ethiopia, in order to produce problem solving citizens by the application of active learning, it has focuses on mathematics and science education. In fact; STM (Science Technology and Mathematics) is a focus area for the Ethiopian Government for the national education system and a manifestation of the country's overall development endeavor. Increasing the number of students experienced in STM and promoting sufficient and qualified graduates ready to pursue STM careers or advanced studies is critical to the country's rapidly growing economy(Belay, Atnafu, Michael, & Ermias, n.d.).

In particular the Ethiopian Government has decided on a current ratio of the study of natural science (including mathematics) to social science of 70%,30% at university level. Hence, active learning is expected to be implemented in mathematics classrooms at all education levels of the country. To recognize the objective of Ethiopian government active learning is expected to be implemented widely particularly at secondary schools.

This is mainly important at generally secondary schools where students learn independently, because any problem and misunderstanding at this stage may affect individuals not only in their

future learning but also in their work throughout life. This implies that the status of the implementation of active learning should be continuously assessed.

As already discussed above, in Ethiopian mathematics education, the curricula were designed to provide students with the mathematical knowledge and skills in order to develop problem-solving and decision-making skills for everyday use (MoE, 2002 P.39). However, the researcher has observed that in the mathematic classes at Ethiopian general secondary schools many students, including those who are potentially successful, become uninterested in mathematics and fail to learn it well and to attend the mathematics class. They don't understand mathematics as a dynamic, exciting and a creative discipline.

To be happen this problem, among other factors, such as pedagogical approach puts forward the necessity of social construction of mathematical meaning and the role of the teacher as facilitator in this construction process. It includes a view of the learner as an active problem-solver working individually and in small groups to make connections between multiple forms of representations of mathematical concepts.

The teachers have been required only to explain to students set of sequences of procedures prescribed by textbooks. Thus teachers familiarized to teaching the traditional curriculum may lack knowledge about mathematics learning and teaching methods that is essential to implementing fruitful changes in the classroom learning culture (Daley, 2003,pp.23-30; Tanner & Jones, 2000,p.43).

In view of the above, it is clear that there are many challenges in promoting teachers' use of active learning approaches. It is in consideration of the above that the researcher became interested in exploring the nature of the teaching–learning process in line with the active learning approaches and investigating the problems related to the implementation of active learning approaches in mathematics education in the Amhara Ethiopia.

1.2. Statement of the Problem

In the Ethiopian context the previous curriculum design and instructional processes suffered from the old, traditional approach (MOE, 2002). Hence continual curriculum revisions have been made and different programs were designed by the new education and training policy of the country to offer quality education and to make the active learning approaches practical at different levels of the country. For instance, the Teacher Education System Overhaul (TESO)

program was introduced in 2003. In this document, among other major programs, one emphasizes is the implementation of participatory, active- learning in the pre-service and in-service programs of teacher education (MOE, 2003: p, 31).

The study found that even though the employment of active learning and teaching is emphasized in Ethiopian policies, however traditional lecture methods, in which teachers talk and students listen, dominate most classrooms. Some research studies were conducted on the implementation of active learning approaches in Ethiopia and the current practice of active learning approach in general secondary schools and higher institution levels. The findings of those researches related to the major factors that hinder the implementation of active learning approach are explored. For instance (Sirak 2000, p.51) indicates that about 58% of class activities in teachers' training institutions were tending to be teacher-centered while 42% were identified as student-centered. The study conducted by (Oli 2006, p.84) discovered that the status of the active learning approaches in teachers' education colleges was also relatively low (less than 50%). (Case, 2012) conducted a research on Teachers' Perceptions and Practices of Active Learning in Harames University, Eastern Ethiopia and the study reported that large class size, shortage of instructional material, lack of skills in selecting a variety of methods and lack of awareness on what active learning is, are the major factors that affect the implementation of active learning.

Olana & Amante (2017) in the study factors affecting implementation of student centered learning methods finding shows that factors such as low attitude towards Student Centered learning, inadequate instructional resources, shortage of time allocated to each teaching period and lack of motivation on teachers because of unfavorable working condition are responsible for small practice of student center learning.

But, in order to make the teaching of mathematics more significant to the immediate needs of the students, society, and the country, it is imperative to improve the quality of Ethiopian secondary school teachers through direct involvement of their students in active learning approaches as a means of resolving the differences in their educational backgrounds. However, the traditional "explanation by the Teacher" style is common as indicated by observation and informal interviews. Hence, the researcher believes that this study will be helpful to fill the existing gap in current practice of active learning approach and thus, it is of vital importance to investigate factor influencing the implementation of active learning approach in mathematics education in general secondary schools of Waghimra Zone, Amhara regional state.

1.3. Research Questions

This study, attempted to answer the following questions:

1. To what extent is active learning approach implemented in mathematics education in the general secondary schools in Waghimra Zone, Amhara, Ethiopia?
2. What are the major factors/challenges influencing the implementation of active learning approaches in these general secondary schools?
3. What are the attitudes of general secondary school teachers and students towards active learning approaches?

1.4. Objective of the Study

This study has both general and specific objectives

1.4.1. General Objective

The purpose of this study was to explore factors affecting implementation of active learning approaches including attitudes of practitioners and the implementation of these approaches in mathematics education.

1.4.2. Specific Objectives

The specific objectives of this study are:

1. To examine the extent of implementation of active learning approach in mathematics education in general secondary schools in Waghimra zone, Amhara;
2. To identify the major factors/challenges in implementing active learning approach in these general secondary schools.
3. To determine the attitudes of teacher and student in general secondary schools towards active learning approach.

1.5. Significance of the Study

The results of this study would provide information on the problems that are currently experienced in the teaching of mathematics at the general secondary schools in Waghimra zone, Amhara, Ethiopia. These results would be pivotal for applying the education and training policy in general and in instructional processes in particular.

The results may also provide recommendations for solutions to problems experienced. Since the authorities at the various levels of educational administration are responsible for creating conducive working environments in educational institutions and for guiding practitioners, they may also benefit from the findings of the present study.

In view of the above, this study would help general secondary schools teachers, students; department heads, principals, Woreda Education Officers and other concerned bodies to design measures for addressing the possible problems related to the implementation of an active learning approach in general secondary school mathematics education.

1.6. Delimitation of the Study

In Waghimra zone there are 8 woredas and 20 general secondary governments ‘administered schools that is grade 9-12. Sekota town is one of these woredas therefore this study is geographically delimited to sekota town general secondary schools in Waghimra zone, Amhara regional state, being specific to Wag Syum Admasu and Sekota General Secondary schools. Conceptually this study is delimited to current practice and factors affecting the implementation of active learning approach in mathematics education.

1.7. Limitations of the Study

There were limited literatures related with current topic to go further discussion. Moreover, the research was also limited by the fact that the sample secondary schools were all public/government owned there were not includes privately schools.

1.8. Operational Definition of terms

Active learning; Active learning is an activity that engages students in doing something in class room besides listening to a teacher.

Active learning approach: is a process were learners actively involved in teaching and learning activity.

Class size: number of learners regularly scheduled to meet in administrative and instructional unit.

General Secondary and preparatory school: the upper of a divide recognized secondary and preparatory school, comprising usually grade 9 to12

Learning approach; a learning approach is a method, or a way of dealing with learning material to facilitate understanding.

Traditional Teacher- centered method; is a methodology that gives the priority role and responsibility to the teacher. The teacher is placed at the center of instruction and is thought to hold most of the knowledge necessary for students to be successful.

Attitude; the belief and view/feeling of teachers or students on the implementation of active learning approach.

CHAPTER TWO

2. REVIEW OF RELATED LITERATURES

The researcher had broadly reviewed studies related to the concepts of learning approach, active learning approach, merits and demerits of active learning approach, some methods of active learning approach, major strategies of implementing active learning approach, and common factors affecting active learning approach.

2.1. Learning Approaches

A learning approach is a method, or a way of dealing with learning material to facilitate understanding (Felder & Brent, 2001, pp.69-74). Learning strategies that, together with the philosophical concept, define the learning approach are the elements used by teachers to help students understand the information in depth. The responsibility in this case is the teachers' with the emphasis on planning, processing and methods of implementing the learning.

2.2. Active Learning Approaches

Active learning is an activity that engages students in doing something besides listening to a teacher. Students may be involved in communicating with one another, or writing, reading, and reflecting individually. In this approach students may also be actively involved by means of discovering, processing, and applying information. In active learning, students are involved in varieties of active learning approaches such as cooperative/collaborative learning, inquiry learning, problem-based learning, discovery learning and projects within and out of the classroom (Benek-Rivera & Mathews, 2004, p.104; Starke, 2007, p.8).

Study has demonstrated that students learn more if they are actively engaged with the material they are studying. Active learning approaches place students at the center of the teaching-learning process and it can be identified by at least some of these characteristics (Pimentel, 2003).

- ✓ Students are involved in more than just listening and taking notes, they participate in a variety of class activities, and often interact with one another (in discussing, reading, presenting and sharing their writing);
- ✓ Students are involved in higher-order thinking skills (including analysis, synthesis, and evaluation);

- ✓ Students reflect on their learning and their learning processes;
- ✓ Greater emphasis is placed on students' exploration of their own attitudes and values; and
- ✓ Less emphasis is placed on transmitting information but more on developing students' skills.

According to McCormack and Jones (1998, p.14), active learning is anything that students do in a classroom other than merely passively listening to a teacher's talk. This includes everything from listening practices that help students to absorb what they hear, to short writing exercises in which students react to the material, to complex group exercises in which students apply subject area material to "real life" situations and/or to new problems.

Concerning students' learning Starke (2007,p.4) says that, they must talk about what they are learning, write about it, and relate it to past experiences, apply it to their daily lives. They must make what they learn part of themselves. Using strategies designed to promote active learning within mathematics can greatly enhance the learning and teaching experience of students and teachers respectively(Gatewood, 2013).

2.3. Merits and Demerits of Active Learning

2.3.1. Merits of Active Learning

The most important value of active learning is that it increases students' retention and comprehension of the course material. Tasks to be executed should be made explicit. Active learning utilizes the students' data and knowledge base. Students have an opportunity to provide personal insights and interpretation. The process allows students to experiment with ideas, to develop concepts, and to integrate concepts into systems. Research showed that active learning seeks to engage a greater range of students in effective mathematics learning. Furthermore, it positively affects the attitude of students toward self and peers in the mathematics learning process .Active learning develop social experiences between students themselves and between teacher and students. It can build community within the classroom.(B. M. Alemu, Education, & Education, 2010)

Active learning focuses on the mathematics teaching purpose. It helps the teacher select objectives at the exact level of difficulty to meet the students' needs. The teacher encourages the students to be responsible for their own mathematics learning. Active mathematics learning

brings the students into the organization, thinking and problem-solving process of the discipline. Active learning also gives the teacher time to perform the helping educator functions of teacher, listener and activist.

The teacher's role in an active learning approach is much more crucial than that of the teacher in the teacher-centered approach. For students to gain the best value of active learning, the teacher needs to change from the role of authority and assumed expert who holds all knowledge to become a facilitator who provides a setting in which the students can play an active and inquiring part in their own learning.

Create a learning environment that stimulates and challenges students, fosters critical thinking and the process of knowledge construction (Powell & Honey, n.d.). The following are other key advantages of the active learning approaches, which are summarized by different authors (Duffy & Kirkley, 2004, pp.21-42), - Active teaching and learning approaches may, amongst other things, allow for or encourage,

- ✓ High level of participation, Students usually find such activities energizing and are likely to engage more with the subject matter as a result.
- ✓ Use of prior experience or knowledge, all students has previous experiences and knowledge of some kind and active strategies offer them the opportunity to make informal connections with things they have already learned.
- ✓ Adoption of new perspectives and positions, The opportunity to discuss topics with others and to listen to or address other points of view (as in small group work or role play, for example) may often lead to the revision of existing perspectives and to enhanced learning opportunities.
- ✓ Peer support and peer learning, Collaborative activities (such as group work or simulations) provide students with opportunities to learn from and support each other in ways that are not facilitated by more formal, teacher-centered approaches.
- ✓ Critical reflection on action and experience, By sharing knowledge and experiences, by being encouraged to take a different perspective on a particular topic (e.g. in a debate) students may learn to reflect critically on the things they do and say.
- ✓ Greater ownership of and responsibility for learning, Active teaching and learning approaches may encourage students to become more self-directed and self-motivated. By taking on a more enquiring and autonomous role, they are more likely to develop a sense of

'ownership' in relation to their learning and to be able to build on this independently in later life.

- ✓ Development of generic communicative skills, Active learning affords many opportunities for students to develop interpersonal and communicative skills; as well as being important in any search for employment; these skills are essential to personal effectiveness in a range of contexts.

2.3.2. Demerits of Active Learning

The key shortcomings in using active teaching and learning methods may include,

- o Shortage of time, Active learning approach may take more time.
- o Teachers' view of their role.
- o Student groups may be dysfunctional, Not all students are expert collaborators; students may bring personal issues to the learning contexts that effectively disrupt the learning experience for others. .
- o Teachers may feel they lack the expertise or confidence; some colleagues may be genuinely interested in moving towards more student-centered approaches in their work, but may feel unable to do so because of a lack of confidence or knowledge of what such approaches might require (Duffy & Kirkley, 2004:pp,21-42;)

2.4. Teaching Methods that Influence Active Learning

The purpose of this part of chapter two is to examine teaching methods that influence learning in mathematics education. Effective learning is the act of developing and refining knowledge not only mentally, but also physically, cognitively and emotionally. It is an active process of internalizing knowledge through inquiry and experience (Santrock, 2001, p.58).

The challenge in education today is to effectively teach students of diverse ability and differing rates of learning. Teachers are expected to teach in a way that enables students to learn mathematics concepts while acquiring process skills, positive attitudes and values and problem solving skills. A variety of teaching methods have been advocated for use in mathematics classrooms, ranging from a teacher centered approach to more student-centered ones.

Effective mathematics teaching at School requires the use of appropriate methods and techniques to meet the demands of the current generation of students and the ever changing educational

environments but the challenge is to find new ways to stimulate and motivate the creative abilities of today's generation who have higher expectations from learning than mere memorization. Furthermore, the traditional "chalk and talk" teacher-centered approach has its own merits, but with the student as the passive recipient of knowledge may not be suitable for today's generation (Balch, 2005, pp.29-34; Emmer & Gerwels, 2002, pp.84-87; Hoffman, 2001, pp.5-10).

It is believed that the lack of appropriate teaching methods has one way or the other hindered learning achievement among students. The teaching methods presented in this part of the study are cooperative learning and inquiry learning. The content knowledge and skills that the students are supposed to acquire are presented in the context of those teaching methods. Teachers who set out to implement an active learning approach should therefore first familiarize themselves with best practices such as providing adequate and extensive support and guidance when students are first introduced to the method, followed by gradual withdrawal of the support as the students gain more experience and confidence in its use.

2.4.1. Cooperative Learning Method

Modern constructivist thought provides the theoretical basis for cooperative learning, problem-based learning and other discovery-oriented learning-teaching processes, all of which support mathematical learning. As students are exposed to their peers' thinking processes, they take cognizance of others' ideas and ways of thinking (Slavin et al., 2003, p.187). Therefore, constructivists make extensive use of cooperative learning tasks, as well as peer tutoring, believing that students will learn more readily through dialogue with each other about significant problems. To acquire new information, ideas or skills, students have to work actively with each other in purposeful ways. In cooperative learning situations, students are not simply taking in new information or ideas regarding mathematics. They are creating something new with the information and ideas. These acts of intellectual processing or of constructing meaning or creating something new is crucial to learning.

Cooperative learning is one aspect of active learning in which students interact with one another while they learn and apply course material in the mathematics classroom. Cooperative learning is at the heart of problem-based learning. It is related to collaborative learning, which emphasizes the "natural learning" that occurs as a result of the interaction in the community in which

students work together in unstructured groups and create their own learning situation (Lea et al., 2003,pp.321-334).

Cooperative learning is also a mathematical teaching technique that brings students together to learn in small, heterogeneous groups. In these groups, students work interdependently without constant and direct supervision from the teacher. Assignments are structured so that everyone contributes. Challenges as well as rewards are shared. Brainstorming, lively discussion and collaboration are the hallmarks of the cooperative-learning classroom. Moreover, cooperative learning is one of the main active learning approaches, along with collaborative learning. It is well documented that students retain more knowledge when actively engaged in the learning process and cooperative learning is often cited as an extremely effective learning and teaching method (Felder & Brent, 2001, pp.24-25). Cooperative learning is more than students working together in teams. According to Vaughan (2002, pp.362-364) the five essential elements of cooperative learning are,

- Clear positive interdependence between students,
- Face to face interaction,
- Individual accountability,
- Emphasis on interpersonal and small group skill, and
- Processes in place for group review to improve effectiveness.

In view of the above, cooperative learning of mathematics is a structured process in which team members work towards accomplishing a common goal, stressing positive interdependence, individual accountability and group accountability.

Positive interdependence is a state in which all members must cooperate to accomplish the goal. Under the accountability rules, each member is individually and collectively responsible for the group's work product (Lowyck & Poeysae, 2001, p.512).

Cooperative learning differs from collaborative learning in that the former "requires carefully structured individual accountability" (Lowyck & Poeysae, 2001, pp.509-510). In contrast, some authors distinguish between collaborative and cooperative learning as having distinct historical developments and different philosophical roots. Cooperative learning is a form of collaborative learning in which students work together on structured assignments or projects under conditions that assure positive interdependence, individual accountability, periodic face-to-face interaction,

appropriate development and use of interpersonal skills and regular self-assessment of group functioning (Baines et al., 2007, p.678). The core element of cooperative learning is the emphasis on student interactions rather than on learning as a solitary activity.

Cooperative learning may promote the active exchange of ideas, critical thinking skills and retention. Cooperative learning reduces classroom anxiety created by new and unfamiliar situations faced by students and can therefore be of particular importance for mathematics teaching (Slavin et al., 2003, p.189). The implication of cooperative learning for the teaching of mathematics at School Many potentially successful students become disinterested in mathematics, and fail to learn it well (Cohen et al., 2004,pp.23-25). Furthermore, women are particularly affected in this way, so traditional teaching practices may partially account for the small numbers of successful female mathematics students in School.

The effects of cooperative learning on attitudes are evidenced by increases in self-esteem, social acceptance and teacher ratings of students (Koppehnaver & Shrader, 2003, p.17). Cooperation is working together to accomplish shared goals. Within cooperative activities individuals seek outcomes that are beneficial to themselves and beneficial to all other group members in mathematics education. Carefully structured cooperative learning during a mathematics class involves students working in teams to accomplish a common goal, under conditions that involve both positive interdependence and individual and group accountability.

Mathematics teachers should encourage positive interdependence by assigning each mathematics student some meaningful role or allow students to assign these themselves. The teacher can also encourage positive interdependence by dividing materials, resources, or information among group members.

2.4.2. Inquiry-Based Learning Method

Inquiry-based learning is an active learning focused on questioning, critical thinking and problem solving. Inquiry-based learning activities begin with a question followed by investigating solutions, creating new knowledge as information is gathered and understood, discussing discoveries and experiences, and reflecting on new-found knowledge. Inquiry-based learning is frequently used in mathematics education and encourages a hands-on approach where students practice the mathematical method on authentic problems (questions) (Bissell & Lemons, 2006, pp.66-72).

(Lee 2004,p.32) makes this point, observing that inquiry is also consistent with interactive lectures, discussion, simulation, service learning and independent study, and in fact "probably the only strategy that is not consistent with inquiry-guided learning is the exclusive use of traditional lecturing" (Karagiorgi & Symeou, 2005,p.24). In this study, the researcher will use the term inquiry learning to refer to instruction that uses questions and problems to provide contexts for learning and does not fall into another more restrictive inductive learning category.

The inquiry-based teaching method is a method where active processes of seeking understanding occur. It produces new ideas, which contribute to human civilization. Every person has the potential to create new ideas and the process of inquiry is both an individual and interpersonal adventure. Students are naturally curious and eagerly seek to understand the world around them. This is the essence of inquiry. The teachers' task is to create situations in which each student can discover the power of ideas and generate concepts about the world. This method is designed to teach students how to investigate a question or a problem through the systematic gathering of facts. The teacher has to guide the students to help them to work towards a solution to a problem.

Generally, (Bissell and Lemons 2006,p.69) have identified the following roles for teachers in an inquiry method, develop lessons that develop students' abilities to recognize problems, suggest tentative answers, identify and gather relevant facts and critically assess tentative solutions. There are skills of inquiry, and development of these skills is an explicit process when inquiry methods are used. If a student plays a primary role in inviting an inquiry lesson, a teacher must facilitate the process. The teacher designs a problem or questions for investigation and ensures that the students have access to data that allow examination of problem.

Regarding the role of students in the inquiry method, students begin their analysis by responding to open-ended questions. These are the questions that ask the students to simply describe or compare and contrast, and have variety of acceptable answers. It is also the student that connects what is new to his or her past experiences and knowledge. To increase student participation time to think is needed (Karagiorgi & Symeou, 2005, pp.225-26).

The main aim of inquiry teaching is to stimulate or promote independent resourceful thinking. Involving students in the inquiry method is one of the most effective ways to help them to develop their higher order critical thinking skills for students' inquiry involves learning through explanation and investigation (Clark & Starr in Feden & Vogel, 2003,pp.37-39).

In inquiry, experiences can take place in the classroom, in interaction with the literature or outside during a field trip. While inquiring, the student uses sight, smell, touch and the kinesthetic sense to gain general and specific information that will help to form concepts and categories for making sense of experiences(B. M. Alemu et al., 2010).

Educator states, "Tell me and I forget, show me and I remember, involve me and I understand." The last part of this statement is the essence of inquiry-based learning in mathematics education at School (McKeachie, 1999, p.159). Inquiry in mathematics learning implies possessing skills and attitudes that permit students to seek solutions to questions and issues while they construct new knowledge.

Inquiry-based learning is a research-based method that actively involves mathematics students at School in the exploration of the content, issues and questions surrounding a course area or concept in mathematics education. The activities and assignments in an inquiry-based learning mathematics classroom can be designed in such a manner that students work individually or together to solve problems involving both in-class work and fieldwork. While the method is meant to be highly student-focused, the extent of teacher-directed verses student-directed learning can vary depending on the level of the students in their subject and their understanding of the inquiry process. Other than increasing student motivation, one of the main reasons to use inquiry-based learning for mathematics teaching is because it provides an effective means to actively involve students in the mathematics learning process(B. M. Alemu et al., 2010).

Inquiry-based learning gives teachers the opportunity to help students learn the content and subject concepts by having them explore a question and develop possible answers. This gives mathematics students more opportunity to reflect on their own learning, gain a deeper understanding of the course concepts in an integrated fashion and become critical thinkers.

2.5. Some Major Strategies of Active Learning

To be effective, in the teaching-learning procedure, teachers should use different active learning tactics. Because current thinking and practice in education highly advocates the need to actively involve the learner in their learning. There are lots of strategies that help to implement active learning in the classrooms. Though, only some of them are deliberated in this section under.

2.5.1. Group Work

Group work is part of collaborative strategies of teaching learning. It is one of the best ways of inspiring active learning by placing the learners' work together in group. It can take many forms including pairs of students working together, up to ten learners together or it can involve students who work individually and come together in groups to compare and discuss the results of their group. If necessary, arbitrary, gender, interest and ability groups can be formed (kyriacou, 1998: p, 39).

2.5.2. Discussion

Discussion in the classroom is an vital kind of active learning strategy(Mulatu, 2017). This strategy gives room for the students to exchange, explore and share their views (Nardos, 2000: p, 196). However, they need to be managed and organized well to be effective. The purpose of discussion is to examine information in order to develop a deep and broader understanding of a topic. Nevertheless, students should have prior knowledge and experience with a current topic for discussion to be successful. In line with this idea, Frazee, et al (1995) argued that, through discussion there is an opportunity for higher order thinking and increased interaction among all students.

2.5.3. Brain Storming

This is when the students create as many ideas as possible about a topic-an ideal storm! It can be a great way to start a class on any given topic. It may be done in a number of different ways: in groups –recording their ideas on chart paper, in pairs, or as a whole class, with the teacher (or a student) writing the ideas on the board or chart paper. It is a great way of finding out of the students what they already know on a subject as well as an outstanding review activity. (Bonwell and Eison, 2003:p,132)

2.5.4. Problem Solving

Problem solving is an instructional system where teachers and learners attempt in a conscious, planned and purposeful effort to arrive at some solution (Aggarwal 1996: p, 91). Learning; through problem solving focuses on activities that are relevant and useful to the life of the learner than just learning by remembering facts that may have no connection with the learners' life.

Studies recommend that problem-based learning advances more positive student attitudes, fosters a deeper approach to learning and helps students retain knowledge longer than traditional instruction (Peterson, 2004). Further, just as cooperative learning provides a natural environment to promote interpersonal skills; problem-based learning provides a natural environment for developing problem-solving and life-long learning skills. Indeed, some evidence shows that problem-based learning develops enhanced problem-solving skills in mathematics students and that these skills can be improved further by coupling problem-based learning with explicit instruction in problem solving.

2.5.5. Project Method

A project is a natural, life like learning activity involving the investigation and solving of problem by individuals or a group of students (Mulatu, 2017). Ideally, project work should consist of a task to realize some definite goal of real personal value.

The project method involves cooperative investigation of real life situation or problem under the supervision of the teacher. It encourages students to plan and carry out investigations of real life situations in the students' immediate environment individually or in group (Dary and Terry, 2000: p, 17). In general this approach produces a close contact with real life situations, encourages co-operations in between learners; offers opportunities to play a leadership role.

2.5.6. Peer-Teaching

Peer-teaching is a participatory, active and democratic strategy integrated in to the students' own experience; that results in deep learning. Peer- teaching involves occasional use of students in the class who have experiences because of their good background in specific area. Peer-teaching is also an appropriate strategy to be applied in teacher training program. It can solve the problem of large class size and it may release teacher educators' time for personal research or for producing resource based learning material (Benet et al., 1996: p, 38)

2.5.8 Assessment of Students during Active Learning

In constructivist learning environments assessment is not a separate examination at the end of the course; rather, assessment methods are integrated into the learning process itself. Specifically Assessment in mathematics focuses on problem solving, research and exploration of possible answers or solutions and developing projects as well as presentations. There is emphasis on

group collaboration rather than individual work. Learning and assessment methods comprise of open-ended questions and scenarios, creating portfolios and descriptive narratives (Roblyer, 2006). Assessment alone is not the end goal but it needs constructive feedback based on conducted assessment.

Feedback is a mechanism of providing information to the learners on their current state of performance, achievement and progress (learning).Teachers communicate to their students on how well or poorly they are performing. After assessment, teachers ought to give feedback and follow-up activities (UNESCO, 2009). Feedback is an important aspect in assessment processes. Constructive feedback will address the learners' individual differences. Each individual teacher should select a feedback mechanism to employ.

2.6. Factors Affecting Implementation of Active Learning Approaches

2.6.1. Attitudes of the Students

Attitudes are psychological concepts composed of emotional, cognitive and behavioral components. New bill, (2005, p.41) as cited at Birhanu attitudes have social, value, useful, and defensive functions for the students who hold them.

Effective employment of active learning approaches enables students to get deep understanding of mathematical concepts and problem-solving skills which are essential to identify and tackle real problems employing appropriate mathematical methods. This approach has positive effects on students' academic achievement. Besides from promoting academic achievement, students should be taught with attitudes and values that are appropriate to their lives as students and for career development.

If active learning is properly implemented in mathematics education, students become successful in their learning. On the other hand, ineffective use of this approach brings academic failure. This in turn affects students' attitudes towards active learning methods and the subject.

2.6.2. Attitudes of Teachers

The view of secondary school teacher towards teaching and learning has an impact on their beliefs and attitudes towards learning approaches in general and the implementation of active learning in fields like mathematics education in particular.

According to Azuka B.F.et al(2013,p.3)attitude of teachers towards activity-based learning is an issue in education of students because if the teacher is not positively disposed to activity-based learning, he/she would not achieve the purpose and its objectives of the lesson in school. People's favorable attitudes towards their profession have a positive effect on their performance.

Since the attitudes and beliefs of teachers vary; copying the mathematics teaching and learning methods employed at one school to another may not be successful. Thus, it is necessary to inculcate positive attitude in teachers towards teaching and learning methods which the teachers need to adopt. They should also accept their own and the students' appropriate roles and put them into practice in the instructional processes to facilitate students learning. Active learning approaches put the students at the center of the teaching and learning process to construct knowledge by themselves through interaction with the material, their teacher and partners. Thus, in this approach students are active participants. Hence the teacher should be willing to employ active learning.

2.6.3. The Classroom Conditions

The selection of effective teaching and learning methods cannot be done without the accessibility of facilities and favorable classroom and school environment.

Besides community environment of a given institution, the location, size, shape and construction of the classroom, the occurrence and effective management of different instructional facilities like: furniture, resource center, laboratory and library services have direct bearing in the instructional methods.

Zweck in Birhanu (2010, p.99) suggested 10 different types of classroom arrangements, which facilitate active learning approaches. These arrangements include a U-shape, team style, conference table, circle, group on group, work station breakout grouping, traditional classroom, auditorium arrangements etc. Accordingly, the arrangement of desks and tables should allow movement and communication and should be changed whenever necessary so that it is appropriate for the learning experiences that teachers have planned.

2.6.4. Class Size

Class size refers to the number of students regularly scheduled to meet in the administrative and instructional unit, usually under the direct guidance of a single teacher. In Ethiopian context the standard of secondary schools the number of student per one class is 40(Standards, n.d.). It has

its own impact on the teaching-learning process in general and on the implementation of active learning in particular. Class size concerns educators for various reasons because learning can only occur positively when lesson are under appropriate condition both for the students and teachers. The class room size would have its own impact in facilitating or hindering actives of teaching and learning. Hence the idea of class size is becoming a concern and an essential point of discussion among scholars in implementing active learning. These scholars assume that as the class size increases, students face any or all of the following difficulties: lack of clarity of purpose; knowledge about progress; advice on improvement; lack of opportunity to discussion; inability to support autonomous study and helplessness to stimulate students.

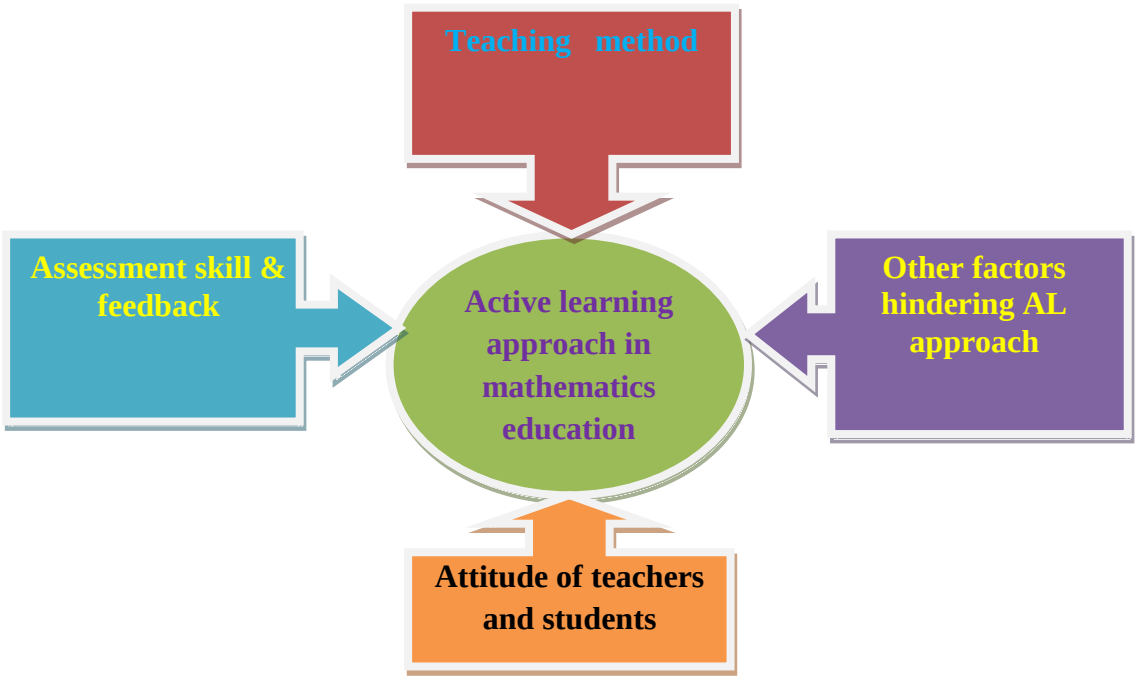
2.6.5. Instructional Material

The organization of the curriculum material (annual plan and daily lesson plan) has an impact on teachers' and students' practices and roles played by them in the teaching learning process. Hence, the annual plan and daily lesson plan should be available to interested parties. Instructional materials, which are categorized into visual aids, audio aids and audiovisual aids, are any materials used as media of communication by the teachers or students to advance learning (Shores in Felder & Brent, 2001, p.23).

2.7. Conceptual Framework of the Study

The conceptual frame work of the study shows the relationship between the dependent variable and independent variable. As indicated in figure-1 active learning approach in mathematics education is dependent variable and teaching method , influencing factor, assessment skill and teachers and students attitude are independent variables that affect active learning approach in mathematics education in the study area. As the teaching method gives a great chance to learner to them self the active learning approach is well exercised, assessment skill is also one indicator of active learning approach, attitude of teachers and students toward active learning approach is also one dominant variable and other influencing factors are affect active learning approach in mathematics education.

Figure 1 conceptual frame work of the study



CHAPTER THREE

3. METHODOLOGY OF THE STUDY

The main purpose of this study is to explore the nature of the teaching– learning process in line with the active learning approaches and identify the major challenges/factors that hinder the implementation of active learning approach in mathematics education in some selected government secondary schools. The study were focus on the major factors/challenges in implementing active learning approaches in these general secondary schools of Waghimra Zone in Amhara Region, Ethiopia.

3.1. Research Design

The research design is the plan and procedures for the study, providing the overall framework for collecting the data. According to Creswell (2009) for mixed research, the overall strength of the study was greater than either qualitative or quantitative methods. That means, employing both qualitative and quantitative methods are preferable because using both methods enable the researcher to verity and validates the data. Therefore, to conduct the study, in this study a mixed methods approach was applied.

The specific type of research design that used for the quantitative phase of this study was a descriptive survey. In descriptive survey research, the researcher selects a sample of subjects and administers a questionnaire to collect data (Creswell 2009, p.36). The descriptive survey was used to describe the attitudes, beliefs, and opinions of the respondents towards the nature of active learning approach in schools.

The research design in the qualitative phase was a phenomenology. This was to get insight into the phenomenon from the participants' views. It was also contextual. According to Creswell (2009, p.16), a context represents a specific set of properties that pertain to phenomena and a contextual study tends to be descriptive and exploratory. The context of this study was mathematics teaching at secondary school in Waghimra Zone Amhara, Ethiopia. In this phase, observation and interviews were used.

3.2. Research Sites

The study was conducted in 2 selected government secondary schools in Waghimra Zone Amhara Region, Ethiopia. So, the research sites for this study were selected governmental

secondary schools in Sekota town. In Waghimra zone, there are twenty general secondary schools. Among them, two Secondary schools namely, Wag Syum Admasu Wosen general secondary and preparatory school and sekota general secondary and preparatory school were selected using purposeful sampling technique. Because the main reasons why these schools selected for this research were

1. The schools selected for this research were a government secondary school in sekota town, and Sekota is the capital of Waghimra Zone such that students from various areas were came in to Sekota. This gives a chance to the researcher to get students who came from different areas and schools with different background.
2. These schools are located around the working place of the researcher this was also leads to save financial expense and time and also that was enabling to collect necessary data as required.
3. These schools were believed that represents other Secondary schools in terms of material and Human resource, socio-economic situations, class size and other factors. The schools have been a target school for various studies and hence may be fertile background information are available.

3.3. Population and Sampling Techniques

3.3.1. Populations of the Study

A research population is well-defined collection of individuals or objects known to have similar characteristics. In the two selected secondary schools, there were 1300 grade nine and grade ten students, and 18 mathematics teachers. Therefore, the total population of this study was 1300 grade nine and grade ten students and 18 mathematics teachers who teach mathematics in these schools of grade 9 and 10 students. The reason why the researcher selected grade nine and grade ten students was that these students are learn all subjects with in equal weight and they are so matured that they are better than the rest of grades in the schools to give relevant information to the research questions.

3.3.2. Sampling and Sample Size of the Study

Sampling is the process of selecting a group of people, events, behaviors or other elements with which to conduct a study. The sources of information for this study were two selected secondary school students and their mathematics teachers. The sample size of students respondents was determined by using Solvin's formula of sample size determination that is $n=\frac{N}{1+Ne^2}$, where n is required sample size, N is the total population and e is tolerance error (Confidence level) therefore calculated sample size is $n=\frac{1300}{1+1300(o.1)^2}$, n=92.857≈ 93. 93 students were sampled from two schools by using simple random sampling technique(lottery method) and all mathematics teachers who teach mathematics in grade nine and ten were selected using comprehensively purposive sampling technique.

The simple random selection of student gives chance to all students who are potentially success full and low achievers at the same time hence the study includes all students who have different learning style. The mathematics teachers in selected schools are small in number so the data can be easily handled by researcher thus it is better to include all mathematics teachers as respondent therefore appropriate sampling method is that purposive sampling method.

Table 3.1: Population and Sample Size of Students

Subjects of the study	Grade	Populations			Sample Size		
		Male	female	total	male	female	Total
Students	9th	370	430	800	24	36	60
	10th	240	260	500	14	19	33
	Total	610	690	1300	38	55	**93**

3.4 .Methods of Data Collection

The main objective of the study is to explore the nature of the teaching– learning process in line with the active learning approaches and identify the major challenges/factors that hinder the implementation of active learning approach in mathematics education. To achieve this objective, the data was collected through questionnaires, observation and in depth –interview. Questionnaires were prepared for students and mathematics teachers; a questionnaire containing

mainly closed ended items was administered to mathematics teachers and students. The respondents responded on different items concerning their use of active learning approaches and the major factors that hinder the implementation of this approach in government secondary schools in Waghimra Zone of Amhara Region, Ethiopia. The questionnaire implemented a four point Likert Scale with the following meanings: 1 = strongly disagree, 2 = Disagree, 3 = Agree, 4 = strongly agree.

In this study the observation method of data collection is used practically to assess the extent of implementation of active learning approaches in mathematics classrooms. The classroom observations focused on the following areas:

- What teachers and students do at the start, during and at the end of a lesson?
- The extent to which appropriate active learning methods are implemented by teachers or not; and
- Whether students individually or in a group are free to express their opinions and to interact with each other and their teachers. The researcher sat in the participants' class during their regular mathematics time and used an observation sheet to record what he saw, heard, and experienced during a teaching session (Gay & Airasian 2000:p.213).

In total 8 observations (two teachers from each two sample schools) were twice observed. Semi-structured interviews were conducted with two mathematics department heads and four observed teachers. A flexible approach was used regarding the interview guide. The interview guide focused on two issues:

(a) The results of the questionnaire and

(b) The lessons that were observed by the researcher. In both cases the target was to further clarify and thus to complement the quantitative and the observation data.

3.5. Reliability and Validity of Instruments

In a mixed methods approach, the study implements data triangulation. Gay and Airasian (2000: p, 201) point out that triangulation gives wide coverage of education characteristics and allows for crosschecking of information. The aim of triangulation is to ensure the validity and reliability of the findings.

To validate the instrument, before the actual data collection was started; the instruments were given to 5 experienced teachers, two mathematics teachers and three psychology and curriculum teachers who are teaching in Sekota College of teacher education, so as to get valuable comments and criticisms on the strengths and weaknesses of the items. Therefore, the teachers claimed some words that included 'homework' needed to be replaced by 'worksheet'; and 'huge classes' needed to be replaced by 'large class size'. In addition, the item 'I believe students learn mathematics by doing things' needed to be modified to: 'I believe students learn mathematics through repeated practice approaches'.

In this study the researcher pilot tested the questionnaire on a small scale before using it on a larger scale with the sampled teachers and students who are not part of the main study. Thus it provided a trial run for the questionnaire that involved testing the phrasing of the questions, identifying unclear questions, determining how long it takes to complete the questionnaire, and if all significant content has been included. After administering the instruments, some participants were asked for feedback. Hence, some of the questions were refined and the total time to complete the questionnaire was 10 to 15minutes.

In addition to this for this study, reliability was done statistically by means of the Cronbach alpha correlation coefficient. The computed reliability of the instruments regarding to implementation of active learning was 0.712. A correlation coefficient closer to one indicates that a scale was more internally reliable. Many researchers agree that a reliability coefficient of 0.7 or above is acceptable. Thus; the instruments were found reliable to collect data for the main study and then administered as scheduled.

3.6. Data Analysis Method

The study was followed mixed method approach; both qualitative and quantitative approaches. The quantitative data obtained from mathematics teachers and students through the questionnaires was analyzed by using frequencies, percentages and mean values. Qualitative data obtained through observation of classes and interviews with the teachers were analyzed qualitatively (using words). After cross checking results from the two instruments, conclusions were drawn.

3.6.1. Qualitative Approach

The data that were collected from class Room observation and interview with teachers were analyzed qualitatively (using words).

3.6.2. Quantitative Approach

The data that was gathered from teachers and students through questionnaires were presented in frequency distribution table and analyzed by considering mean and percentages of alternatives in the items.

3.7. Data Collection Procedures

For students 93 questionnaires each containing 13 items was distributed to them and the items were translated in to Amharic language so as to make easily understandable and for teachers 18 questionnaires each containing 35 items were distributed to them. Finally, the English version of the items was used in the report. Semi structured class room observation was conducted. Semi-structured interview having 7 questions was provided for six mathematics teachers these teachers were selected using purposive sampling technique based on their experience of teaching mathematics in secondary school. All the items are concerned about active learning approach in mathematics education and factors that hinder the implementation of active learning in mathematics class room.

3.8. Ethical Considerations

Before starting to conduct the study, the researcher was receive a letter of cooperation from Bihar Dar University and was assure permissions from the selected study area administrators. The researcher was not interfering with response of respondents. Both students and teachers were be informed about the purpose of the study and would be aware to participate in this research voluntarily and honestly. The data that taken from respondents is not be submitted to other authorized persons without their permissions. All the information is kept confidentially by using only representative codes for school respondents.

CHAPTOR FOUR

PRESENTATION AND ANALYSIS OF DATA

INTRODUCTION

This chapter discusses the presentation and interpretation of data. In doing so, the data collected through questionnaires are presented with the help of tables. These results are complemented by data obtained by means of qualitative methods, namely classroom observation and interviews. The chapter presents the findings on the extent to which the secondary school mathematics teachers implement active learning approaches. This includes the extent to which teachers help students to actively participate in the teaching-learning process; implement active learning approaches while assessing, and factors which hinder the implementation of active learning approaches in sample schools. The chapter also highlights the attitudes of teachers towards active learning approaches.

4.1. Analysis and Interpretation of Students' and Teachers' Biography

Before discussing the data related to the basic questions, a summary of the characteristics of the subjects is presented here. Two biographical variables were select to students and seven biographical variables were selected to teachers on the basis of their potential to influence teachers' use of active learning approaches. The biographical variables included: the teachers' Gender, Age, years of teaching experience, Educational qualification, teaching workload per week and average number of students in a class.

Table 4.1: The biographical variables of students are analyzed as follows

Grade Level	**Sex**			
	Male	Female	Total	percentages
9th	24	36	60	64.5%
10th	14	19	33	35.5%
total	38	55	**93**	**100%**
percentages	40.9%	59.1%	100%	

Among respondent students 40.9% were males and 59.1% of them were females. With respect to grade levels, 64.5% were grade 9 and 35.5% of them were from grade 10.

Table 4.2: Biographical Data of Teachers

Variable	ITEM	frequency	percentage
Gender	Male	15	83.3%
	Female	3	16.7%
Age:	29 yrs. and younger	1	5.6%
	30-39 yrs.	16	88.89%
	40-49 yrs.	1	5.6%
	50 yrs. and older	-	-
Experience in teaching:	Less than one year	-	-
	1-5 yrs.	1	5.6%
	6-10 yrs.	12	66.67%
	11-15 yrs.	4	22.2%
	More than 15 years	1	5.6%
Level of Education:	Bachelor's degree	18	100%
	Master's degree	-	-
Teaching workload per week :	Less than six credit hours	-	-
	6-10 credit hours	-	-
	11-15 credit hours	9	50%
	More than 15 credit hours	9	50%
Average number of students in a class:	Less than 40	-	-
	41-50	12	66.7%
	51-60	6	33.4%
	More than 60	-	-

According to Table 4.2, 5.6% were 29 years and Youngers and 88.89% of the respondents were between 30 and 39. Only 5.6% of the respondents were 40 years and older. Of the respondents, 83.3% were male and 16.7% were female. This study therefore shows that the participation of females as mathematics teachers at secondary school is low.

Almost 66.67% of the respondents have form 6 to 10 years teaching experience served as a teacher. Therefore, this was relatively low work experience. About 5.6% the respondents have between one to five years of experience as beginners, while only 27.8% of the respondents worked as experienced teacher for 11 and more years. All of the teachers (100%) had attained a Bachelor's degree in mathematics education. This indicates that hard work is required of the Amhara Regional education Bureau to develop and capacitate secondary school teachers.

Workload influences teaching style. In this regard Table 4.2 indicates that only 50% of the respondents had a workload that between the ranges from 11 to 15 credit hours; and 50% of the

teachers have workloads more than15 credit hours. The implementation of active learning approaches requires a certain amount of time to think about and explore each topic. Such approaches may take more time than a lecture. Heavy workloads and excessive material to cover motivates teachers to fall back on teacher-centered approaches that they are familiar with rather than use active learning approaches.

The above information was complemented by the qualitative data. Classroom observation also indicated that the classroom seating arrangement does not allow teachers to employ active learning approaches. Front to back seating arrangements encourage one-way communication only since such seating arrangements discourage students from talking among themselves and focus attention on the teacher.

During interviews respondents complained that the large class sizes does not allow them to change this type of seating arrangements and it also has a great impact on the implementation of active learning approaches. According to Table 4.2, most teachers (66.67%) a typical have 41-50 students and 33.4% replied that classroom generally has 51-60 students. This was confirmed by classroom observations: the researcher observed 51 to 55 students in a given class. Only a very small number of students ever spoke to respond to questions. It was therefore difficult to implement active learning approaches.

4.2. Active Learning Approaches and Influencing Factors

This part of the study was to assess the nature of the teaching-learning process in line with the active learning approaches and the major factors that hinder the implementation of these approaches in mathematics education at secondary school in waghimra zone. Using questionnaires supported by classroom observation and interviews, the following was determined: Thus are teachers' use of active learning methods, the extent to which teachers implemented active learning approaches while assessing, the factors that hindered the implementation of active learning approaches in the sample school and the attitudes of teachers and students towards active learning. The data taken from the questionnaires, classroom observation and interview results were analyzed in line with the above mentioned concepts.

4.2.1. The Use of Active Learning Approaches while Teaching:

Table 1.3: The extent of implementing active learning approach while teaching

NO.	Students opportunities to actively participate in the teaching- learning process	Strongly disagree (1		Disagree (2)		Agree (3)		Strongly agree (4)		Mean
		f	%	f	%	f	%	f	%	
1	I rarely arrange the students into groups for mathematics team work	1	5.6	4	22.2	11	61.1	2	11.1	2.78
2	I encourage students to ask questions.	-	-	6	33.3	12	66.7	-	-	2.56
3	I often confront the students with problems to solve.	-	-	6	33.3	10	55.6	2	11.1	2.78
4	I encourage students to deduce general principles from practical experiences.	2	11.1	11	61.1	5	27.8	-	-	2.17
5	I consciously create conditions to stimulate students' need to know.	-	-	6	33.3	12	66.7	-	-	2.56
6	I discuss worksheet results with students.	-	-	7	38.9	11	61.1	-	-	2.61
7	I consciously facilitate problem solving in the mathematics class.	-	-	7	38.9	10	55.6	1	5.6	2.67
8	I support the students to discover the desired conceptual knowledge in the learning process for themselves	-	-	8	44.4	10	55.6	-	-	2.56
9	I think that discussions between the students on new topic are vital for deep understanding	-	-	7	38.9	10	55.6	1	5.6	2.67
10	I generally link new knowledge to students' prior experiences	2	11.1	6	33.3	8	44.4	2	11.1	2.56

Regarding teaching method, an item one is arranging the students into groups for mathematics team work in the mathematics learning process, 61.1% and 11.1% agreed and strongly agreed (mean value of 2.78) respectively. This is in line with item nine that asked discussions between the students on new topic are vital for deep understanding: about 61.2% (55.6% and 5.6%) showed their agreement (mean value of 2.67); item 7 that asked if teachers facilitate problem solving (a mean of 2.67) and supported by 61.2% of respondents but in item 4 students were

encouraged to deduce general principles from practical experiences: it is not supported by about 72.2% (11.1% and 61.1%, strongly disagree and disagree mean value is 2.17). This shows that disagreement between item seven and item four.

On consciously creating conditions to stimulate students' need to know, 66.7% of the respondents agreed. And also 61.1% of the teachers indicated that they discussed worksheet results with students. In item 8 the majority of the respondents (55.6% and mean 2.56) indicated that they supported students to discover the desired conceptual knowledge in the learning process for themselves. Most of the teachers thus seem to realize the importance of active, discovery learning.

In response to the above all teaching method items teachers invented that they use lecture method only some times. But the observation result tells that they tend to use lecture method frequently. From the teachers' responses, therefore, one can say that active learning is frequently employed in the school. Yet, the observation result and some interviewees' responses disprove this.

Teachers make many instructional decisions that can either discourage or promote an active learning environment for mathematics. Four teachers were observed as they were teaching mathematics at two different schools. In some instances, two lessons were observed on different days. It was noted that most of the observed teachers in the sample schools did not make use some of basic activities; teachers did not:

- ✓ Use a wide variety of teaching methods to engage students in learning (e.g. brain storming/linking previous knowledge and experience; using appropriate wandering; questioning strategies; encouraging higher level thinking skills; implementing flexible grouping; differentiating instruction; and accommodating print, non-print, and electronic resources);
- ✓ Request students to demonstrate the solution process on the chalkboard. When students work out problems on the chalkboard, the teacher develops a sense of potential misunderstandings in the solution process. Working problems out at the chalkboard gives the teachers another tool for student assessment;

In addition to the questionnaires and classroom observations, seven semi-structured interviews were held with the teacher participants. When the teachers were interviewed on how they used

active learning approaches in mathematics teaching, some of them were positive. Two examples include:

> *I have practiced active learning for the last six years. I am really interested and believe in the views of active learning. It is exactly the way in which one can learn. I have also taken the training that improves my method of teaching. Before two years, I really thought that using active learning was wastage of time. But now I can practically see that students learn more when they are engaged in activities that make them participant [teacher A, April 8/2011].*

In the same token, another interviewee also shares the same idea in regards to the importance of active learning approach as follows;

> *I have always preferred to encourage students to learn through activity rather than through passive listening and note taking. Active learning has been deeply embedded in my teaching for many years. Letting go of the classic lecturer 'font of all knowledge' position is actually very liberating! Once you have created the climate for a more active learning contribution, then it tends to grow by itself and you learn along with the students [teacher E, April 14/2011].*

Some teacher interviewees feel indifferent about active learning approach, it pros and cons, as can be seen from the following example:

> *My understanding about active learning approaches is that both teacher-centered and active learning approaches have positives and negatives [teacher B, April 8/2011].*

Other teacher interviewees on the contrary shows negative attitude towards active learning approach and they hesitate on its outcomes. The following is one example.

> *I am concerned that problem solving and cooperative learning method is becoming overworked and that without a broad range of source data for reference the 'problem' is more guesswork. In such cases, it may be that students are active, enjoy the activity and remember the desired outcomes without truly challenging their own existing concepts. I do not believe in 'active learning' but I feel that using simple gaps to allow students to review what has been discussed could make teachers much more active [teacher C, April 11/2011].*

Some others develop a negative attitude towards active learning after certain experiences that discourage them to continue applying active learning in their classrooms. The following verbatim from teacher interviewee were a clear testimony.

> *When I tried active learning in one of my classes, many of the students hated it. Some refused to cooperate and made their hostility to the approaches and for this reason most of the time I am using explanation and description of the steps for each problem [teacher D, April 11/2011].*

4.2.2. The Use of an Active Learning Approach While Assessing

Table 4.4: The extent of implementing active learning approaches while assessing.

NO.	Item that are need to be conduct while assessing	Strongly disagree (1		Disagree (2)		Agree (3)		Strongly agree (4)		Mean
		f	%	f	%	f	%	f	%	
1	I have too much work to evaluate students continuously.	5	27.8	2	11.1	10	55.6	1	5.6	2.39
2	I frequently ask close-ended questions for which there is only one correct answer.	2	11.1	7	38.9	9	50	-	-	2.39
3	I praise students' work as often as possible	1	5.6	6	33.3	11	61.1	-	-	2.56
4	I frequently ask open-ended questions.	-	-	9	50	9	50	-	-	2.50
5	I often assess students' understanding during group work.	3	16.7	7	38.9	8	44.4	-	-	2.28
6	I often assess students' understanding through questioning.	-	-	3	16.7	11	61.1	4	22.2	3.06
7	I provide exercises on some of the lessons.	-	-	3	16.7	9	50	6	33.3	3.17
8	I often assess students when they solve problems in a group.	1	5.6	6	33.3	11	61.1	-	-	2.56

Implementing active learning approaches starts with involving the students in making decisions about their progress.

What is outstanding in Table 4.4 is the following: In response to the item testing respondents' views if they have too much work to evaluate students continuously, 61.2% (55.6% and 5.6%) of the respondents are agreed and strongly agreed on this. This was confirmed by observation. As was informed during interviews, the evaluation of students was "once up on time". Although teachers were divided on the issue of frequently asking close-ended questions for which there is only one correct answer, observation revealed that teachers tended to ask such close-ended questions.

In addition to the above, all most 61.1% of teachers indicated that they praised students' work as often as possible; most of teachers(83.3% and mean of 3.06) that they often assessed students' understanding through questioning; (50% plus 33.3%, mean of 3.17) that they provided exercises on some of the lessons; but 50% of teachers are not ask open-ended question; 56.6% and mean 2.28 of teachers were not assess often students' understanding during group work and around half of teacher are not assessing students when they solve problems in group. With regarding to assessment of students while teaching it was noted that most of the observed teachers in the sample schools did not make use some of basic activities; teachers did not:

- ✓ Use cooperative groups for problem solving activity. Students were not allowed to present and explain their solutions to problems on the board to the other students;
- ✓ Encourage students to investigate problems further by asking them questions that begin with "what, when, where and how".
- ✓ Do ongoing formative assessment throughout the learning period. This might be accomplished through "jig sawing" solutions to pre-determined mathematics problems and/or requiring small student groups to solve problems at the board.

Table 4.5: factors that hindered the implementation of active learning approaches

NO.	Factors that hinder active learning approach	Strongly disagree (1)		Disagree (2)		Agree (3)		Strongly agree (4)		Mean
		f	%	f	%	f	%	f	%	
1	There is a lack of time to actively involve students in my classroom teaching	1	5.6	7	38.9	10	55.6	-	-	2.50
2	It is impractical to implement active learning in large class size.	-	-	3	16.7	15	83.3	-	-	2.83
3	The rigidity of the time table prevents the implementation of an active learning technique.	-	-	1	5.6	15	83.3	2	11.1	3.06
4	Lack of classroom space inhibits group work.	-	-	2	11.1	16	88.9	-	-	2.89
5	Lack of resources affects the implementation of active learning			1	5.6	14	**77.8**	3	16.7	3.11

Table 4.5 Shows factors hindering the implementation of active learning approaches. Five factors were assumed to hinder the implementation of active learning are presented.

In order of importance (as indicated by the percentages and means), the following were mentioned as the most factors that hindering the implementation of active learning approaches.

Lack of time to actively involve students in teaching (55.6%, mean 2.50) are agreed; large classes size (83.3%, mean 2.83) are agreed; Rigidity of the time table that prevents implementation of active learning techniques (94.4%, mean 3.06) are agreed; Lack of classroom space that inhibits group work (88.9 %, mean 2.89) agreed and on item 5 lack of resources affects the employment of active learning almost all teacher are agreed that means 94.4% and mean of 3.11 of the respondent are approved that shortage of instructional materials are the most factor that hinder the implementation of active learning approach.

Although questionnaire responses indicated that teachers believed that there was not enough space for group work, but classroom observation showed that most of the classes had enough space for group discussions And It was also observed that in the sample school no teachers arranged their students into groups for different activities.

During the interviews, participants were asked their experience about implementing active learning approach and they provide the following responses.

> *My students have expectations of the role of the teacher and their role as students. Active learning challenges these expectations. Actively participating in the class may be viewed as a failure of the teacher to carry out his/her responsibilities. There may be a sense that the expertise of the teacher is lost to the students and shortage of time. Such factors make its practicability less even though it is useful [teacher B, April 18/2011].*
>
> *I experienced that active learning gives me less opportunity to deliver content consequently; I need to decide whether there will be material on exams not covered directly in class. If so, I should be mindful to reserve class time for the more challenging concepts [teacher D, April 14/2011].*
>
> *Theoretically active learning is very useful, but practically it is impossible for a number of reasons like large class size, work load of teacher, lack of teaching material, and lack of interest and some criticisms of both the teachers and students… [Teacher F, April 8/2011].*
>
> *I think I see active learning differently. Some think as if it is totally practical "TESO" guide line for assessment for example, is theoretically very useful, but practically impossible for a number of reasons like large class size ,work load of teachers, lack of teaching material, lack of interest and some complaints of both the instructors and students. The same holds true with active learning implementation. Therefore, provision of teaching materials, budget and technology should be considered to make it effective. In addition to the above factors, teachers' lack of interest and training on such methodology may affect its practicability. If all these problems are minimized and the teachers accept it willingly active learning may become suitable in different situations [teacher A, April 8/2011].*

The data obtained from classroom observation is also proved that the classroom condition and seating arrangement is not convenient to implement active learning. One major problem observed in the classroom is the lay-out of the classes. The physical environments of the classroom did not conducive for active learning practices.

4.2.3. The Attitudes of Teachers and Students towards Active Learning Approach

Table 4.6: Teachers attitudes towards active learning

NO.	Items that measure attitude of teachers	Strongly disagree (1		Disagree (2)		Agree (3)		Strongly agree (4)		Mean
		f	%	f	%	f	%	f	%	
1	I use lectures to help students to develop critical thinking skills.	3	16.7	7	38.9	8	44.4	-	-	2.28
2	I prefer classes in which students are quiet	4	22.2	8	44.4	6	33.3	-	-	2.11
3	I believe group work discourages students' mathematical insight	4	22.2	7	38.9	7	38.9	-	-	2.17
4	I believe students learn mathematics through repeated practice	1	5,6	6	33.3	11	61.1	-	-	2.56
5	I believe problem solving enhances students' learning of mathematics	2	11.1	9	50	7	38.9			2.28
6	I believe students dislike active participation in class.	5	27.8	6	33.3	7	38.9	-	-	2.11
7	In active learning my responsibility is to facilitate students' learning.	2	11.1	6	33.3	9	50	-	-	2.39
8	I feel that good lectures enhance students' sense of commitment.	1	5.6	6	33.3	11	61.1	-	-	2.56
9	constrictive feedback is impractical in large classes	-	-	-	-	10	55.6	8	44.4	3.44
10	I believe students learn more effectively if they work individually than in groups	3	16.7	7	38.9	8	44.4	-	-	2.28
11	It is impossible to learn actively in large classes	-	-	-	-	11	61.1	7	38.9	33.39
12	I think well prepared lectures are most important for student achievement	-	-	-	-	10	55.6	8	44.4	3.44

Table 4.6.1 indicates in order of importance (as indicated by the percentages and means) the following attitudes of teachers as most influential, as indicated by their responses. Teachers indicated their view that:

- ✓ Active problem solving enhances students' learning of mathematics (61.1% of respondent agreed mean 2.56);
- ✓ Here also 61.1% of teachers believe that students learn mathematics through repeated practice (mean 2.56)
- ✓ Half of respondent support that their responsibility in active learning was to facilitate students' learning; as shown above the table some of the teachers have good attitude towards active learning approach.

In other hand, some of the teachers were supports that the traditional teacher centered approach of teaching-learning process. That is;

- ✓ Most of teacher support that good lectures enhance students' sense of commitment (mean 2.56);
- ✓ Same of respondent are prefer classes in which students were quiet ; and
- ✓ Almost all teachers are agreed that well prepared lectures is most important for student achievement (mean 3.44)

It was also confirmed during classroom observations that the predominant mode of teaching learning was teacher-centered. The class was taught as a whole, and all students were expected to cover the same amount of material, in the same way.

Table 4.7: Students' Attitudes towards Active Learning

NO.	Items attitude of students	Strongly disagree (1		Disagree (2)		Agree (3)		Strongly agree (4)		Mean
		f	%	f	%	f	%	f	%	
1	My teachers encourage us to reflect during the process of constructing knowledge.	5	5.4	25	26.9	40	43	23	24.7	2.87
2	I believe group work discourages me mathematical insight	21	22.6	46	51.6	24	25.8	-	-	2.03
3	I believe that I learn mathematics through repeated practice	1	1.1	8	8.6	58	62.4	26	28	3.17
4	Our teacher motivate us to actively participate in the teaching- learning process	5	5.4	25	26.9	40	43	23	24.7	2.87
5	I believe problem solving enhances me learning of mathematics	1	1.1	8	8.6	57	61.3	27	29	3.18
6	Generally our teacher link new knowledge to our prior experiences	5	5.4	32	34.4	49	52.7	7	7.5	2.62
7	I dislike active participation in class.	21	22.6	48	51.6	24	25.8	-	-	2.03
8	In active learning my teachers' responsibility is to facilitate our learning.	1	1.1	8	8.6	58	62.4	26	28	3.17
9	I feel that good lectures enhance my sense of commitment.	5	5.4	25	26.9	40	43	23	24.7	2.87
10	I learn more effectively if I work individually than in groups	21	22.6	48	51.6	24	25.8	-	-	2.03
11	There is no time for reflection in our classes.	5	5.4	25	26.9	40	43	23	24.7	2.87
12	It is impossible to learn actively in large classes	1	1.1	8	8.6	58	62.4	26	28	3.17
13	I think cooperative work in groups is good for efficient learning.	5	5.4	25	26.9	40	43	23	24.7	2.87

It is not only teachers' attitude that affects the effective implementation of active learning instructional method at mathematics education. The attitude and expectations of students also affect how learning is viewed and how teaching is organized (Derebssa, 2006 p, 133).

In relation to this, 13 items were presented to students to find out their attitude to words active learning approach.

In table 4.6.2 item 3 states "I believe that I learn mathematics through repeated practice". In responding to this item 62.4% of the students were agreed whereas 8.6% of them were expressed their disagreement. This indicates that the students have good understanding on the idea.

Item 5 states "I believe problem solving enhances me learning of mathematics." The statement is supported by the most of participants, particularly 61.3% of the respondents were agreed and 29% of them strongly agreed with the idea. This seems to generalize that most of them have the assumptions that problem solving enhances them to learning of mathematics. But the responses on item 5 was contrary to the response about the feeling of that good lectures enhance them sense of commitment in learning mathematics shows that 43% of the students were strongly agree whereas 24.7% of them expressed their agreement.

In item 8 of Table 4.6.2 'In active learning my teachers' responsibility is to facilitate our learning'. In responding to the item, the majority of the respondents (28%) replied that they strongly agree with the idea, and 62.4% of them again showed their agreement. Item 11 on the luck of time to reflect students work on their class room, 43% of the respondents were agreed whereas 24.7% of them were strongly disagreed. Almost 90.4% of respondents were assumed that active learning approach in mathematics education is impossible in large class size. In item thirteen 67.7% of the student were agreed on cooperative work in groups is good for efficient learning.

Most of teachers and students seem to have positive attitudes towards active learning. Hence, the two groups have perceived active learning positively. But, the observation result and the responses from the interview reflect that they do not implement active learning in their classrooms.

4.3. Result and Discussion

In this section the results of the study were discussed regarding teachers' use of active learning approach in class while teaching and assessing students, major factors affecting the implementation of active learning approaches and, attitudes of teachers and students towards active learning approach.

4.3.1. The extent of Teachers' usage of Active Learning Approach

Active learning approaches focus on students to play a more active and dominant role in their learning. Thus, it gives to the students an opportunity to learn through their own efforts and to take full responsibility for their own learning with the teachers as facilitators.

The results of this study indicate that the extent to which secondary school mathematics teachers implemented active learning approaches at various stages of the teaching process is low. It is not only teachers' attitudes that affect the implementation of active learning approaches. The attitudes and expectations of students also affect how learning is viewed and how teaching is organized.

It is known that learning is active when students take initiative and responsibility for their own learning and this is dependent on students' positive attitudes. This is not the case in the samples schools, where observation indicated that the majority of the teachers mainly used teacher centered approach to teach students to solve mathematics problems and they rarely arranged the students into groups for mathematics team work. This may be caused by large class sizes. Table 4.3 also shows that the majority of the sample teachers thought that a well prepared lecture could stimulate students to solve mathematics problems. However, students build and share their own knowledge with others when they interact with each other and with their teachers (Zweck, 2006: pp, 112-114).

Furthermore, active learning approaches such as the inquiry method; problem-based learning and discovery methods which foster the critical thinking and problem-solving capacity of students were not widely employed. In this regard Balım (2009: pp, 16-18) emphasizes that students should do more than just listen. They need to read, write, discuss or engage in problem solving activities. In active learning classrooms, students are engaged in activities like dialogue, debate, writing, discussion and problem solving as well as higher order thinking such as analysis,

synthesis and evaluation. Learning includes students' mutual construction of knowledge and their interaction with each other and with their teachers.

In the teaching learning process, lessons can be divided into: starting phase (summarizing work covered in previous lessons); new content introduction phase, central phase (explanation of the content); activities phase (students work on the content); closing (final feedback) phase. The classroom observations showed that all the phases, with the exception of activities phase, are teacher-centered approaches. It was also observed that low level order questions were frequently asked by the teachers. This is also supported by the result obtained from questionnaire item "I frequently ask close ended questions for which there is only one correct answer". Half of the teachers showed their agreement to this item (see Table 4.4).

Further, students in the observed classes were responsible only to listen to teachers, take notes and respond to questions upon request. This is associated with the students' prior experience of active learning, as pointed out by most of teachers. Students have no experience to play the active roles expected of them because many come from dictatorial cultural backgrounds and therefore talk only when motivated by someone. But teachers don't take this into consideration when they encourage student participation in teaching learning processes.

Regarding assessment, teachers did not always know how to assess in active learning approaches, in particular in large class size. Table 4.4 shows that the teachers believed that they had too much work to evaluate students continuously. In addition to this, the students also posed problems. They lacked understanding of assessment and, during group work some were passive while other students did all the work. This show the teachers are need for training.

In most of the sample secondary school it was observed that students were requested to memorize, rephrase, and infer meaning in the teaching-learning process. The use of problem solving, higher order thinking and open type questions was narrowed and limited. Students' activities were recalling information rather than developing understanding by discussing and exploring content. Observation showed that most of the mathematics teacher did not implement active learning approaches as expected at different teaching-learning stages (starter activity, introduction, explanation, and summery). Almost none of the observed teachers praised and encouraged the students, discussed their work individually or followed the students' participation to provide feedback. Table 4.4 indicates that many teachers believed that providing ongoing

meaningful feedback to students was too time-consuming. This relates to negative attitudes towards active learning assessment practices.

4.3.2. Factors Affecting Implementation of Active Learning Approaches

Like any other educational issue in the teaching-learning process, it is also possible to think that active learning may have shortcomings or constraints during its implementation in the real classroom conditions. Of these constraints, the researcher has selected some of the following the most serious possible factors affecting the implementation of active learning in the secondary school. These factors are selected on the basis of their frequencies in the responses of the teachers and classroom observations. According to Table 4.5, many educators believed that lack of classroom space and large classes prevented group work. In addition to this, the followings are prevented active learning: lack of time to actively involve students in teaching; rigidity of the time table that prevents implementation of active learning techniques; lack of resources to implement problem-based learning; lack of instructional materials; and that is took too much effort from teachers. This was confirmed during interviews.

Changes in teaching and learning approaches are likely to mean that the school' resources will become more important to the quality of teaching and learning in general and implementation of active learning approaches in particular. For example, many respondents (see Table 4.5) had lack of time to actively involve students in their classroom teaching. Although teachers may find active learning approaches to be more enjoyable and lead to improved student learning, they still have questions about the amount of time and content that needs to be covered using the approaches.

Time was an issue. Based on their experience, a large number of teachers thought that active learning would take up more time than the traditional way of teaching. Teachers believed that due to time constraints, active learning could not be applied in a short period of time. They also believed that the students were passive and that it took a long time to motivate them.

Class size was also a factor. McKeatchie and Svinicki (2005: pp, 7-9) stated that in a large class, individualization (differentiation) of instruction is limited. Thus, the most frequently used instructional method is the teacher-centered approach, without group participation. In such classrooms even oral student-teacher communication is minimized, written work receives less teacher attention, and students are also less well known as individuals by their teachers.

Interviewees also indicated that a factor that influences the implementation of the approach is interpersonal relationships or interactions among individuals. Active learning approaches are characterized by empathic, supportive relationships which free students to discuss their feelings and experiences, so that students are actively involved in learning through the given opportunities to predict, infer, generalize, and evaluate (Duffy & Kirkley, 2004:p44).

The classroom setup should be conducive to learning; it should stimulate learning through different methods such as problem solving and cooperative learning. From this point of view, the arrangement of desks and tables should allow movement and communication and should be changed whenever necessary. Furthermore, sufficient teaching resources should be available to implement active learning approaches as required. The majority of teacher's respondents replied that they were constrained by lack of adequate resources from using active learning approaches (see Table 4.5).

The data obtained from classroom observation show that the classroom seating (the front to back arrangement) does not allow teachers to employ active learning approaches. The teaching learning resources are not sufficiently available at observed classroom it is also highly hinder the implementation of active learning approach.

4.3.3. Attitudes of Teachers and Students To wards Active Learning Approaches

Ethiopian education policies and implementation strategies encourage active learning approaches that include discussion methods, peer-teaching, cooperative learning, inquiry learning, problem-based learning and etc. To develop critical thinking various research findings confirmed that there is strong tie between teachers' and students' attitudes towards active learning and their effort in implementing it.

Different educators also argued that teacher's attitudes affect the effectiveness of the implementation of active learning approaches. Teachers' and students positive attitudes toward active learning were illustrated by their beliefs (in Table 4.6.1 and Table 4.6.2) that: problem solving enhanced students' learning of mathematics; they motivated students to actively participate in the teaching and learning process; they encouraged students to reflect during the process of constructing knowledge; active problem solving offered students opportunities for quick progress;

Contrary to the above, they also had the following beliefs:

Good lectures enhanced students' sense of commitment and were most important for student achievement; Classes in which students were quiet were preferable to noisy classes; Students learnt mathematics through repeated practice; and there was no time for reflection in their classes.

Thus, students were expected to be silent unless they are directed to respond. This is associated with teachers' and students' lack of prior experience of active learning approaches. Active learning approaches demand teachers not and text book only to be efficient in mathematics, but also in their understanding of how students learn. Without such understanding, it is not easy to motivate teachers to participate in active learning approaches (Derebssa, 2006: p, 136). Active learning approaches request teachers not only to be experts in their fields, but also in their understanding of how students learn. Without such understanding, it is not easy to motivate teachers to participate in active learning approaches (Derebssa, 2006).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter deals with summary, conclusion and recommendations. In this section first, a summary of the study and the major findings are made. Second, conclusions of the fundamental findings are drawn. Lastly some possible recommendations are forwarded on the basis of the findings of the study.

5.1. Summary

The previous chapter, chapter 4, presented the results of this study and a discussion of the results. In this chapter, conclusions in line with the major results and recommendations of the study are presented. Finally, the limitations of the research are highlighted.

The main aim of this study has been to explore the nature of the teaching-learning process in line with active learning approaches and to identify the major challenges/factors hindering the implementation of these approaches in mathematics education secondary schools in Waghimra zone Amhara, Ethiopia. In order to meet these aims, the following three basic questions were listed.

1 To what extent is active learning approaches implemented in mathematics education in the general secondary schools?
2 What are the major factors/challenges influence the implementation of active learning approaches in these general secondary schools?
3 What are the attitudes of general secondary schools teachers and students towards active learning approaches?

To find answers to these basic questions, the study was conducted in secondary school in Waghimra zone Amhara, Ethiopia. The data were collected from 18 mathematics teachers and 93 grade nine and ten students. Using a mixed-methods design, the data were mainly gathered through questionnaires, observations and interviews. The quantitative data obtained were analyzed using frequency percentages and mean values. The qualitative data were analyzed by means of appropriate methods. The major findings based on the above discussion were the following.

Based on the results of the current study (see Table 4.3), concerning the implementation of active-learning approaches while teaching, the following findings are drawn.

The basic active learning activities which were not implemented by most of teachers in the secondary school were:

- Encourage students to ask questions;
- Encourage students to deduce general principles from practical experiences;
- Facilitate problem solving in the mathematics class;
- Support students to discover the desired conceptual knowledge;
- Using a variety of teaching methods to engage students in learning;
- Using cooperative groups for problem solving activities; and
- Facilitating students' interest.

From the above it follows that the extent to which active learning practices are implemented and the opportunities provided to students for active participation in the instructional process in the sample school is low and inadequate. The poor implementation of active learning approaches while teaching is negatively influences the quality of the teaching-learning process in the sample secondary school of the Amhara regional state.

In active learning approaches the progress of the learners is continuously assessed and immediate feedbacks should be provided to the students. But in this study there were some shortcoming concerning learners' assessment among these;

- ✓ The majority of mathematics teachers in the sample secondary school did not assess their students continuously;
- ✓ The majority of teachers didn't employ a variety of assessment techniques;
- ✓ The assessment techniques frequently used by many of the teachers were close-ended questions; only a few teachers used open-ended questions frequently;
- ✓ The majority of teachers provided exercises on some of the lessons only;
- ✓ Many teachers believed that providing ongoing meaningful feedback to students was too time-consuming

- ✓ Many teachers did not know how to assess in active learning approaches, in particular in large classes size;
- ✓ Students posed problems in the sense that they lacked understanding of assessment and, during group work; some were passive while other students did all the work.

The inadequate use of the above mentioned assessment techniques would hinder the development of students' understanding of mathematics.

The results from this study (see Table 4.5) revealed that the major factors in implementing active learning approaches were;

- Classroom conditions: lack of classroom space that inhibits group work and large classes of more than 47 students per class;
- Lack of time to actively involve students in teaching;
- Rigidity of the time table that prevents implementation of active learning techniques;
- Teachers' and students attitudes towards active learning approach too much effort expected from them and
- Lack of instructional materials.

The above listed factors inhibited the implementation of active learning approaches in the sample secondary school. This hindered the opportunities for students to construct their own knowledge. This in turn negatively influenced the quality of the mathematics teaching and learning processes in the sample secondary school Amhara, Ethiopia.

The analysis of the data indicates that almost all of the respondents of the study have perceived active learning positively. However, the extent of perception varies between the teachers and students; i.e. it is higher among the students than teachers. Moreover, it was indicated that:

- ❖ The participant groups assure that when the teachers use active learning, the students learn better and develop the ability to express their feelings confidently.
- ❖ The participants view that active learning plays an important role in developing self-confidence.
- ❖ The respondents who developed negative feeling towards active learning say that active learning adds more work and requires additional effort.

5.2. Conclusions

Many educators describe the constructivist approach to learning as a process whereby students work individually or in small groups to explore, investigate and solve authentic problems and become actively engaged in seeking knowledge and information. Hence, in active learning approaches, students participate actively in their learning and become autonomous learners who actively construct new meaning within the context of their current knowledge, experiences and social environments. They mainly construct knowledge through solving realistic, relevant problems, often in collaboration with others. However, as indicated above, many teachers may keep to teaching mathematics at secondary school in traditional ways. This issue was the motivation for this study. After carefully studying the results, what now follows are the specific conclusions that have been reached.

The difference between what respondents indicated in their questionnaires, and what was observed, may be because teachers knew that active learning was the best method but they did not implement this method because of various constraints. These reasons are illuminated by the results of research questions two to three.

Moreover, it was observed that teacher-centered approaches were the predominantly approach of instruction used in all of the observed classrooms. From these results it can be concluded that although many teacher and students had positive attitudes towards active learning practices. However, because of various influencing factor the implementation of active learning approaches were relatively rare. This issue is negatively affected mathematics learning of students in the sample secondary school Amhara, Ethiopia.

5.3. Recommendations

This study concluded that the extent of implementing active learning approaches in sample secondary school was low. Hence, the following are recommended based on the findings of the study, the researcher would like to forward the following recommendations for the improvement of the practices of active learning.

1) Mathematics teachers in the suggested schools have a positive perception towards active learning approach in mathematics education but most of them are not committed to implement as far as their perception; so that this indicates teachers should committed to implement active learning approach as much as possible. They should start the lesson with

clear learning objectives and share to students, use multiple pedagogical techniques, provide helpful instructional materials and increase the positive relationship with their students.

2) From the background information of teachers it was observed that majority of them have low work experience hence they need to get training on active learning approach specially with the regarding to making students part of teaching learning formative assessment and giving constructive feedback. Therefore, it is important to conduct in- service training so that their use of active learning strategies will be improved.

3) The governmental education sectors have to give due attention for the effective implementation of active learning approach in mathematics education. The sector must emphasize and take commitment in collaboration with schools so as to improve active learning approach in mathematics education.

4) Adequate resources and relatively small class sizes are required. The education Bureau in collaboration with woreda education office and school principals should find mechanisms to minimize the class size and replace the traditional arrangement of furniture in the classroom so as to make classroom conditions conducive for the effective implementation of active learning approaches. The current class size of 47-55 and more should be reduced to the national standard which is 40 students or less.

5) Teacher's on-going support for the implementation of active learning approaches should be addressed as a priority. The school should provide adequate active learning guides and other instructional materials to the teachers by working closely with other stakeholders.

6) The realities in sample secondary school were that active learning had not been adopted in significant ways. Perhaps a more appropriate emphasis of teachers' training efforts should be around student-friendly classrooms progressing towards adoption of active learning approaches in an incremental way. Policies and comprehensive teacher's development plans should be required to move toward active learning and to lay a pathway for change in the future.

7) Preparing students for patriot and problem solver citizen's lifelong learning involves teaching skills to analyze problems, synthesize information and tackle a wide range of tasks. As student's learning will involve errors, tasks should offer opportunities for self-assessment, correction, peer discussion, teacher feedback and other 'reality checks'.

8) Shortages of relevant material resources in the schools were found to be the major factors influencing the implementation of mathematics curriculum. Therefore, MOE through Zone and Woreda Education Offices need to supervise the activities of these schools in general and availability of material resources in particular.

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Appendix 1: Questionnaire for Teacher

Purpose:

This questionnaire has been designed to gather data on the nature of the teaching– learning process in mathematics and the problems that hinder learning. The data collected through the questionnaire will be used only for academic purposes. The Information obtained from respondents will be treated confidentially.

General directions:

• Please follow the instructions carefully.

• Respond to all the questions.

• Hand over the completed questionnaire to your unit leader within three days.

• You do not have to write your name or identify yourself in any way.

Thank you in advance for your cooperation!

Instruction: Please indicate your answer by circling the appropriate number on the right side of each item.

SECTION A: BIOGRAPHIC DATA.

1. Name of the school _____

2. Sex: Male 1

Female 2

3. Age:

a. 29 years and below 1

b. 30-39 years 2

c. 40-49 years 3

d. 50 years and above 4

4. Experience in teaching:

a. Less than one year 1

b. 1 -5 years 2

c. 6-10 years 3

d. 11-15 years 4

e. More than 15 years 5

5. Educational qualification:

a. Bachelor degree 1

b. Master's degree 2

6. Teaching workload per week:

a. Less than six credit hours 1

b. 6-10 credit hours 2

c. 11-15 credit hours 3

d. More than 15 credit hours 4

7. Average number of students in your class:

a. Less than 40 1

b. 41-50 2

c. 51-60 3

d. More than 60 4

SECTION B: MATHEHATICS TEACHERS: TEACHING METHODS

Instruction: To each of the following items, focus on the teaching of mathematics and the problems teachers experience in this regard. The meaning of the numbers is shown in the table below.

Keys: 1= Strongly disagree, 2= Disagree, 3=Agree, 4= Strongly agree

No	ITEM	SCALE			
	Category 1: TEACHING METHODS				
1	I rarely arrange the students into groups for mathematics team work	1	2	3	4
2	I encourage students to ask questions.	1	2	3	4
3	I often confront the students with problems to solve.	1	2	3	4
4	I encourage students to deduce general principles from practical experiences.	1	2	3	4
5	I consciously create conditions to stimulate students' need to know.	1	2	3	4
6	I discuss worksheet results with students.	1	2	3	4
7	I consciously facilitate problem solving in the mathematics class.	1	2	3	4
8	I support the students to discover the desired conceptual knowledge in the learning process for themselves	1	2	3	4
9	I think that discussions between the students on new topic are vital for deep understanding	1	2	3	4
10	I generally link new knowledge to students' prior experiences	1	2	3	4

Category 2: Assessment Scale

1	I have too much work to evaluate students continuously.	1	2	3	4
2	I frequently ask close-ended questions for which there is only one correct answer.	1	2	3	4
3	I praise students' work as often as possible	1	2	3	4
4	I frequently ask open-ended questions.	1	2	3	4
5	I often assess students' understanding during group work.	1	2	3	4
6	I often assess students' understanding through questioning.	1	2	3	4
7	I provide exercises on some of the lessons.	1	2	3	4
8	I often assess students when they solve problems in a group.	1	2	3	4
Category 3: Influencing factors					
1	There is a lack of time to actively involve students in my classroom teaching	1	2	3	4
2	It is impractical to implement active learning in large classes.	1	2	3	4
3	The rigidity of the time table prevents the implementation of an active learning technique.	1	2	3	4
4	Lack of classroom space inhibits group work.	1	2	3	4
5	Lack of resources affects the implementation of active learning	1	2	3	4

SECTION C: ATTITUDES

You are focusing on the teaching of mathematics and the problems that teachers experience in this regard. The meaning of the numbers is shown in the table below.

Keys: 1= Strongly disagree, 2= Disagree, 3=Agree, 4= Strongly agree

No	ITEM				
1	I use lectures to help students to develop critical thinking skills.	1	2	3	4
2	I prefer classes in which students are quiet	1	2	3	4
3	I believe group work discourages students' mathematical insight	1	2	3	4
4	I believe students learn mathematics through repeated practice	1	2	3	4
5	I believe problem solving enhances students' learning of mathematics	1	2	3	4
6	I believe students dislike active participation in class.	1	2	3	4
7	In active learning my responsibility is to facilitate students' learning.	1	2	3	4
8	I feel that good lectures enhance students' sense of commitment.	1	2	3	4
9	constrictive feedback is impractical in large classes	1	2	3	4
10	I believe students learn more effectively if they work individually than in groups	1	2	3	4
11	It is impossible to learn actively in large classes	1	2	3	4
12	I think well prepared lectures are most important for student achievement	1	2	3	4

APPENDX 2: Questionnaire to Student

Purpose:

This questionnaire is designed to gather data on the nature of the teaching– learning process in mathematics and the problems that hinder learning. The data to be collected through the questionnaire is used for academic purposes only. Information that you provide will be treated as confidential.

General directions:

• Please follow the instructions carefully.

• Respond to all questions.

• Please respond within three days. Deliver the completed questionnaire to your monitor.

• You do not have to write your name or identify yourself in any way.

Thank you in advance for your cooperation!

Instruction: Please show your answer by circling the appropriate number on the right of each of the items.

SECTION A: BIOGRAPHIC DATA.

1. Name of the school _____

2. Your gender: Male 1

Female 2

3. Age:

12-16 1

17-21 2

Above 22 3

4. Grade level

Grade 9 1

Grade 10 2

Grade 11 3

Grade 12 4

Instruction: To each of the following items, focus on the teaching of mathematics and the problems teachers experience in this regard. The meaning of the numbers is shown in the table below.

Keys: 1= Strongly disagree, 2= Disagree, 3=Agree, 4= Strongly agree

No	ITEM				
1.	My teachers encourage us to reflect during the process of constructing knowledge.	1	2	3	4
2.	I believe group work discourages me mathematical insight	1	2	3	4
3.	I believe that I learn mathematics through repeated practice	1	2	3	4
4	Our teacher motivate us to actively participate in the teaching- learning process	1	2	3	4
5	I believe problem solving enhances me learning of mathematics	1	2	3	4
6	Generally our teacher link new knowledge to our prior experiences	1	2	3	4
7	I dislike active participation in class.	1	2	3	4
8	In active learning my teachers' responsibility is to facilitate our learning.	1	2	3	4
9	I feel that good lectures enhance my sense of commitment.	1	2	3	4
10	I learn more effectively if I work individually than in groups	1	2	3	4
11	There is no time for reflection in our classes.	1	2	3	4
12	It is impossible to learn actively in large classes	1	2	3	4
13	I think cooperative work in groups is good for efficient learning.	1	2	3	4

በባህርዳር ዩኒበርሲቲ ሂሳብ ትምህርት ክፍል ለ2ኛ ዲግሪ ትምህርት መመረቅያ የሚጠና ጥናት መጠይቅ

ለተማሪዎች ሚቀርብ መጠይቅ

የዚህ መጠይቅ ዋና አላማ በሂሳብ ትምህርት የመማር ማስተማር ሂደት ዙርያ ያለውን ሁኔታ ለመረዳት ነው::በዚህ መጠይቅ የተሰበሰበው መረጃ ለትምህርት አላማ ብቻ የሚውል ሲሆን ይህንንም ጥናት በትክክል አላማውን ከግብ ማድረስም ሆነ አስፈላጊውን የመፍትሄ ሀሳብ ለማስቀመጥ የመጀመርያዎቹ እና ከዋነኛ የመረጃ ምንጮቹ መካከል እርሰዎ ግንባር ቀደም ስለሆኑ በግልፅ የማያሻማና እውነትነት ያለው መረጃ እንዲሰጡኝ በትህትና እጠይቃለሁ። በዚህ መጠይቅ የሚሰበሰበው መረጃ ለዚህ ጥናትና ምርምር ብቻ የሚያገለግል መሆኑን እገልፃለሁ።ስለሆነም መጠይቁ የሚሞሉ መላሾች መረጃው በታማኝነት ይያዛል::

በቅድሚያ አመሰግናለሁ !!

<u>ማሳሰብያ፡-</u>. ሁሉንም መጥይቆች ይሙሉ

. ስማችሁንም ሆነ በሌላ መንገድ እራሳችሁን የሚገልፅ ነገር አይኑር

እባካችሁ መልሳችሁን ከጥያቂው ፊትለፊት ያለውን ቁጥር በማክበብ አሳዩ።

ክፍል 1:የመላሾቹ ዳራ

1. **የትምህርት ቤቱ ስም** ----------
2. **ፆታ ወ 1**
   ሴ 2
3. **ዕድሜ ከ12-16 1**
   ከ 16-21 2
   ከ 22 በላይ 3
4. **የክፍል ደረጃ 9ኛ ክፍል 1**
   10ኛክፍል

አቅጣጫ፦ ከዚህ በታች በሰንጠረዡ ላይ ላሉ ጥያቂዎች ከጎናቸው የተመለከተውን ቁጥር በማክበብ መልሱ።የቁጥሩ መግለጫም በሚከተለው ሰንጠረዥ መሰረት ነው።

መግለጫ:በጣም እስማማለሁ 1 እስማማለሁ 2 አልስማማም 3 በጣም አልስማማም 4

ተ.ቁ	ዝርዝር ሀሳቦች	የመልስ ደረጃዎች/scale/			
1	መምህራኖቻችን በመማር ማስተማር ሂደት ወቅት እንድናንፀባርቅ ስለሚያበረታቱን በጥሩ ሁኔታ እንገለፃለን	1	2	3	4
2	የቡድን ስራ በሂሳብ ትምህርት ጊዜ አያበረታታኝም	1	2	3	4
3	በተደጋጋሚ በመለማመድ ሂሳብን እማራለሁ	1	2	3	4
4	መመህራኖቼ ሂሳብን በምንማርበት ወቅት በንቃት እንድንሳተፍ ያበረታቱን በደስታ እማራለሁ	1	2	3	4

5	የሂሳብ ጥያቄዎችን በመፍታት መማር ሂሳብን እንድረዳ ይረዳኛል	1	2	3	4
6	በአጣቃላይ መምህሬ አዲስ አውቀትን ከማውቀው አውቀቱ ጋር እያገናኘ ያስተምረኛል	1	2	3	4
7	ክፍል ውስጥ በንቃት መሳተፍ አልወድም	1	2	3	4
8	በተማሪ ተኮር ማስተማር ጊዜ የመምህራችን ሀላፊነት መማራችንን ማመቻቸት ነው	1	2	3	4
9	ጥሩ የገለፃ መስተማር ዘዴ ሂሳብን በጥልቀት እንድረዳ ይረዳኛል	1	2	3	4
10	በቡድን ከመማር ይልቅ በግሌ ብሰራ በውጤታማነት እማራለሁ	1	2	3	4
11	በክፍልችን ውስጥ ለማንፀባረቅ በቂ ጊዜ የለም	1	2	3	4
12	ብዙ ተማሪ ባለበት ክፍል በንቃት መማር አይቻልም	1	2	3	4
13	በቡድን ውስጥ በትብብር መስራት በመማር ላይ ውጤታማ ያደርጋል ብዬ አስባለሁ	1	2	3	4

APPENDIX 3: Sample Interview Guide to Teachers

1. What are your personal views on active learning or student-centered approaches in mathematics teaching?

2. Explain how you use active learning/student-centered approaches in your mathematics teaching.

3. How do you assess mathematics learners and why?

4. What problems do you experience regarding the implementation of active learning approaches?

5. Teachers sometimes have positive views on active learning approaches for mathematics teaching and yet do not implement this approach in their own teaching. Why do you think this is the case?

6. What would you recommend that will enable teachers to implement active learning approaches in their mathematics teaching?

7. Is there anything you would like to add?

APPENDIX 4: Class Room Observation Checklist

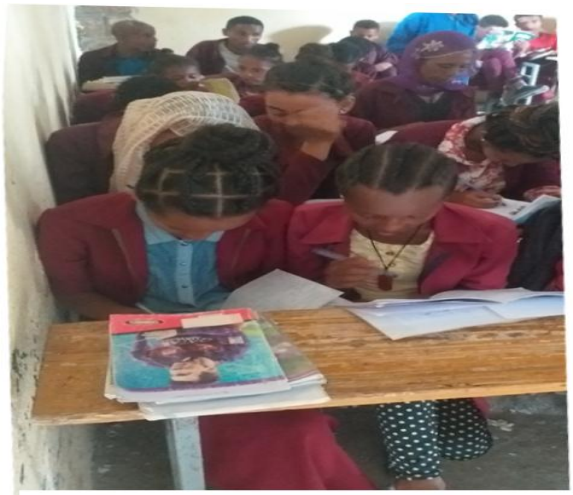
No.	PART ONE ITEM class room condition	YES	NO
1	Is there enough sitting space for all students		
2	Are the desks arranged in straight row?		
3	Is the class size appropriate?		
4	Is there enough space for movement between desks?		
	PART TWO ITEM TEACHERS ACTIVITY		
1	Arranging students for different classroom activity		
2	Clarifying the learning objectives		
3	Giving direction about procedures and Activities		
4	Using different instructional methods to implement active learning		
5	Managing the class for active learning implementation		
6	Using questions to elicit students' ideas		
	PART THREE ITEM STUDENTS ACTIVITY		
1	Students are participating in problem solving activities		
2	Students are playing roles		
3	Students are discussing issues in groups		
4	Students are taking part in peer-teaching		
5	Students are practicing demonstration		

APPENDIX 5: Class Room Observation Photo

The image data gathered while class room observation is conducted

Poor classroom arrangement

Unattractive class room wall



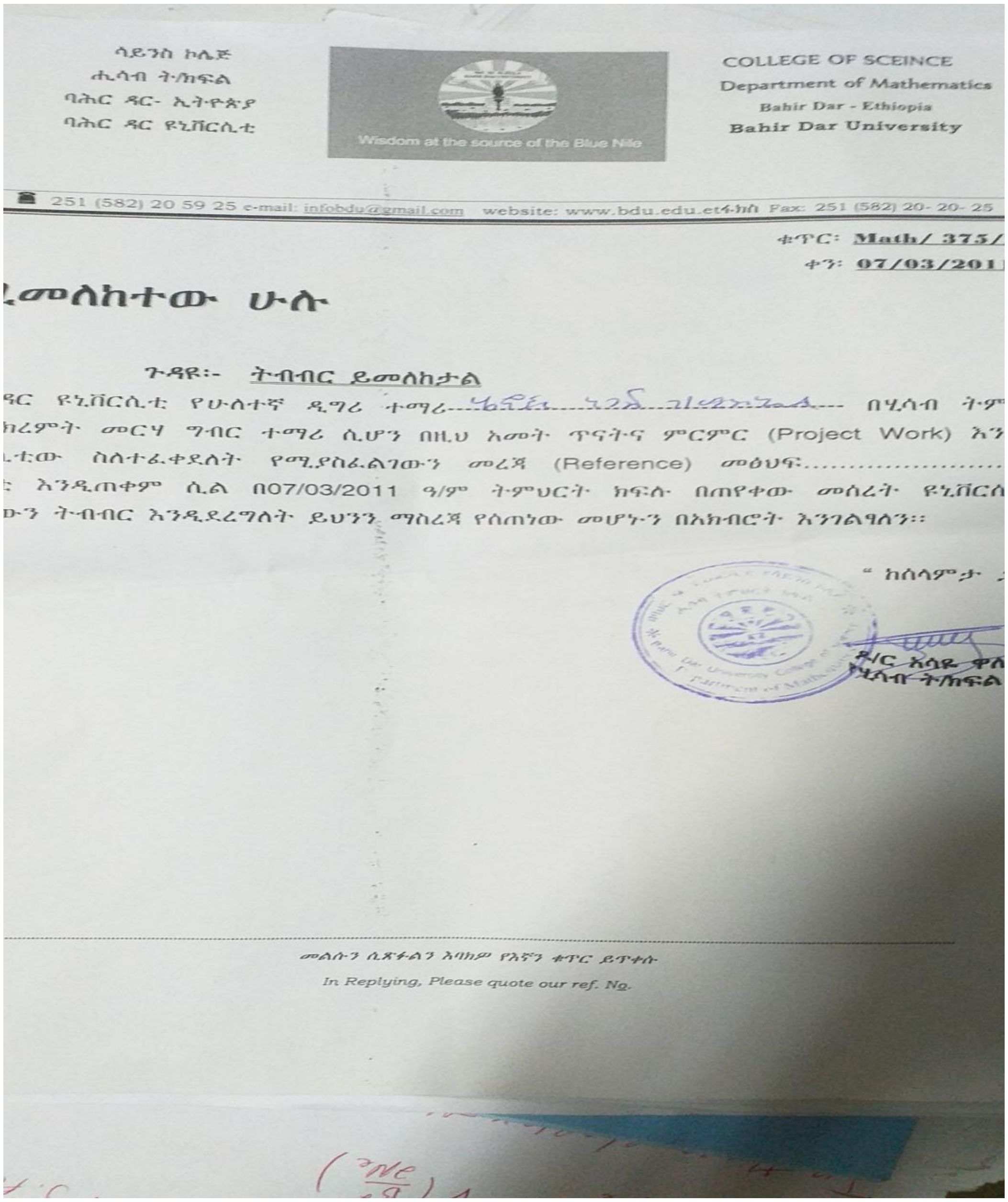
Poor classroom arrangement

Poor classroom arrangement

Poor classroom arrangement

Poor classroom arrangement

APPENDIX 6 - Letter of cooperation from Bahirdar university Department of mathematics



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ሒሳብ ት/ክፍል
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Wisdom at the source of the Blue Nile

COLLEGE OF SCEINCE
Department of Mathematics
Bahir Dar - Ethiopia
Bahir Dar University

251 (582) 20 59 25 e-mail: infobdu@gmail.com website: www.bdu.edu.et ፋክስ Fax: 251 (582) 20- 20- 25

ቁጥር፡ Math/ 375/
ቀን፡ 07/03/201

ሚመለከተው ሁሉ

ጉዳዩ፡- ትብብር ይመለከታል

ዳር ዩኒቨርሲቲ የሁለተኛ ዲግሪ ተማሪ---[illegible]--- በሂሳብ ትም
ክረምት መርሃ ግብር ተማሪ ሲሆን በዚህ አመት ጥናትና ምርምር (Project Work) እን
ሲቲው ስለተፈቀደለት የሚያስፈልገውን መረጃ (Reference) መፅሀፍ......................
፡ እንዲጠቀም ሲል በ07/03/2011 ዓ/ም ትምህርት ክፍሉ በጠየቀው መሰረት ዩኒቨርሲ
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" ከሰላምታ

ዶ/ር አሳዬ ቀለ
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In Replying, Please quote our ref. No.