

THE STATUS AND PRACTICE OF ACTIVE LEARNING IN TEACHING-
LEARNING MATHEMATICS IN SOME SELECTED PERPARATORY
SECONDARY SCHOOLS OF SOUTHERN ZONE OF TIGIRAY REGION

By

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Master of Education (M.Ed) Thesis

Department of Mathematics Education

Addis Ababa University

School of Graduate Studies

College of Education and Behavioral Studies

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Acronyms

AAU=Addis Ababa University

AG= Agree

DA=disagree

ICT= Information Communication Technology

IM = Instructional Materials

MOE=Ministry of Education

SA=strongly Agree

Sd = Standard deviation

SD= Strongly Disagree

SPC= School Pedagogical Center

UD= Undecided

Abstract

The purpose of this study was to investigate the status and practice of active learning and to identify those factors influencing the practice of active learning approach in teaching-learning mathematics in some selected Preparatory Secondary Schools of Southern Zone of Tigray Regional State. Moreover, an attention was given how active learning approach was practiced in teaching-learning of mathematics in the study area. Therefore, this research focused on investigating the status and practice of active learning and related problems to the practice of active learning approach as well as in finding solution for those problems under the study area. In line with this, the researcher used descriptive survey design as a research design in order to have clear picture about the status and practice of active learning approach in teaching-learning mathematics in the study area. Accordingly, four sample schools were selected using random sampling techniques. Furthermore 373 students from the sample schools were selected to fill the questionnaires provided for them by using stratified and simple random sampling techniques. And all mathematics teachers of these schools were included under the study to fill teachers' questionnaires and for the purpose interview. Moreover document analysis and observation was also made by the researcher to get more data regarding the status and practice of active learning under study. Finally the findings of the study generally indicated that most of mathematics teachers had good understanding about active learning approach but they had major problems on how to practice it with in the class room. Some of the major factors that affects the practice active learning approach were lack of professional support, encouragement and understanding of the administration towards active learning, lack of resources like reference books and other supportive teaching materials , teachers lack of interest towards their profession,, lack of students understanding and their attitude towards active learning, tendency of teachers towards the traditional teaching method , shortage of time, volume of the text books (its contents are too vast), students lack of confidence (frightened) and basic knowledge of mathematics from the lower grade as well as lack of awareness of doing mathematics exercise regularly, and finally large class size . Therefore, due to those factor majorities of the teachers used rarely active learning approach in teaching-learning mathematics in the study area.

CHAPTRE ONE

INTRODUCTION

1.1. Background of the study

Education plays very important role in generating a progressive economic development, increasing a competitive world attitude and improving the citizen quality of life. According to Aggarwal (2001,p.5) education is a process which draws out the best in the child with the aim of producing well balanced personalities, culturally refined, emotionally stable, ethically sound, mentally alert, morally upright, physically strong, socially efficient, spiritually upright, vocationally self sufficient, and internationally liberal. In line with this the Ethiopian Educational Training Policy(1994,p.1) define Education as a process by which man transmits his experiences, new findings, and values accumulated over the years, in his struggle for survival and development, through generations. This implies education enable individuals and society to make all-rounded participation in the development process by acquiring knowledge, ability, skills and attitudes. That is, one of the aims of education is to strengthen the individual's and society's problem solving capacity, ability and culture starting from basic education and at all levels (MOE, 1994). Hence to attain this goal, their learning must take place in a context that forces them to realize those activities, it should be active.

In addition to this Dewey (1915) cited in Kuhlthau, et al. (2007, p.14) explained that, "education is not an affair of telling and being told but an active and constructive process." Further Dewey (1940) cited in Gillies and Ashman (2003, p.1) argued that learning should be an active and dynamic process based on children's expanding curiosity in their world. He also believed that learning should be child-centered and responsive to the child's own developing social interests and activities. According to him schools had a responsibility to build on students' natural interest in their social environment by fostering interpersonal communication and group involvement. Along with this the Ethiopia Ministry of Education (1994) also has recently began to promote student-centered design to encourage students and teachers to teach in a more meaningful manner. But most of the times in a usual classroom setting students are observed in listening to the teachers passively in the teaching-learning process, and reading the text book when necessary. But such passive participation of the students leads them to a limited retention of knowledge. However, by re-organizing or adapting the ways teachers' present material to students, teachers can create an environment

in which knowledge retention is significantly increased; of course, such situations require the support of the students themselves. Hence, one of the best methods to involve students in an active participation in the teaching- learning process is active learning approach.

According to Bell and Kahrhoff (2006,p.1), Active Learning is a process wherein students are actively engaged in building understanding of facts, ideas, and skills through the completion of instructor directed tasks and activities. That is students are doing something including discovering, processing, and applying information more than simply listen to a lecture. Also it can be defined as any strategy that involves students in doing things and thinking about the things they are doing and this broad definition can be taken to include a wide range of teaching and learning activities including collaborative, cooperative, inquiry, problem-based learning etc. According to Scales (2008, p.70) active learning doesn't mean learners are busily involved in physical activity, although they might be. Active, in this sense means being actively involved in making meaning rather than just being given information. It seeks to encourage all students to employ the learning strategies of successful students. So, in simple terms, according to Houghton-Mifflin (1998) active learning is defined as engaging students in doing something besides listening to a lecture and taking notes to help them learn and apply course material. In other words students may be involved in talking and listening actively to one another, or writing, reading and reflecting individually.

Furthermore, over the past decade, researchers and instructors around the world have attempted to promote active learning in academic courses. Beichner's (2006)cited in O'Brien, Millis and Cohen (2008,p.4) groundbreaking summary of the research on active learning and its implications for all aspects of teaching and learning, including the design of learning environments, makes it difficult to ignore the mounting evidence that business as usual, preparing and delivering lectures to passive students who then regurgitate “ the facts ” on short - answer or multiple - choice tests , is no longer an adequate pedagogical response to the demands of the twenty - first century. In fact, Finkle (2000) concludes, “Educational research over the past twenty – five years has established beyond a doubt a simple fact: What is transmitted to students through lecturing is simply not retained for any significant length of time” (ibid.). This shows that active learning is an important means for development of student skills and it involves students in the teaching-learning process actively rather than passively.

Therefore, the aim of this study was to assess the status and practice of active learning approach and to find out those factors influencing the practice of active learning approach in teaching-learning mathematics in some selected preparatory Secondary schools of Southern Zone of Tigray Region.

1.2. Statement of the problem

According to Okereke (2006) cited in Ali (2010, p.68), mathematics is the science of things that have a pattern of regularity and logical order and finding and exploring the regularity. That is mathematics is the foundation of science technology and the functional role of mathematics to science & technology is multifarious, that is no area of science, technology and business activities escapes its application, it plays a key role in shaping how individuals deal with the various specialties of private, social, and civil life. Hence mathematics' teachers must plan lessons; work with students individually and as a whole class, and they must present explanations, examples, and definitions as well as they develop assessments, grade student work, and keep track of student progress (Li and Kaiser, 2011, p.42). This indicates that teachers have taken the role of facilitating in the teaching-learning of mathematics.

In addition to this according to Mathematics Syllabus for Grades 11 and 12(2009), Mathematics learning at the second cycle of secondary education should contribute to the students' growth into good, balanced and educated individuals and members of society. At this cycle, they should acquire the necessary mathematical knowledge and develop skills and competencies needed in their further studies, working life, hobbies, and all-round personal development. And these aims can be realized by closely linking mathematics learning with daily life, relating theory with practice; paying attention to the practical application of mathematical concepts, theorems, methods and procedures by drawing examples from the fields of agriculture, industry and sciences like physics, chemistry and engineering. Therefore, the didactic-methodical conception has to contribute to all these sides of the educational process and to consider the specifics of students' age, the function of the secondary school level in the present and prospective developmental state of the country, the pre-requisites of the respective secondary school and the guiding principles of the subject mathematics (MOE, 2009; Mathematics Syllabus, Grades 11 and 12, p. iv). More over the document elaborate that the text book(mathematics) for grade eleven and twelve, and the teaching materials aims to encourage students to explore their surrounding and take active participation in solving social

problems existing in their respective environment, by making them active participant in different forms of cooperative work between peer groups, with the application of the deductive approach, with preparation of project papers, with seminary instruction and discussion forums about special themes. From this one can understand that mathematics education has its own impact on the prospective developmental of the country in general and in fulfilling the educational objectives of the country in particular. Hence to see how mathematics is crucial in the fulfillment of our educational objectives it is important to see the aims and objectives of mathematics text book in our country in particularly in second cycle secondary schools in relation to the general educational objectives of our country.

Develop the physical and mental potential and the problem-solving capacity of individuals by expanding education and in particular by providing basic education for all (MOE, 1994, p.7) is one of the general objectives of the Educational and Training Policies of Ethiopia. In line with this; *the acquisition of solid knowledge on mathematical concepts, theorems, rules and methods assigned in the syllabus, and acquisition of reliable capability in working with this knowledge more independently in the field of problem solving (MOE, 2009; Mathematics Syllabus, Grades 11 and 12,p.iv)* are the general objectives at this cycle (preparatory secondary schools). Hence these objectives have higher influence on the fulfillment of the general educational objectives of our country.

Therefore to achieve these objectives and to worth mathematics in achieving our educational objectives it is important to give attention to the teaching-learning process, teachers and students activity in the class room as well as outside of the class. According to Aggarwal (2001, p.55) the teaching learning process is the means through which the teacher, the learner, the curriculum and other variables like the method of teaching, the class room conditions, teaching materials, questioning and answering, assignment, thinking, enjoying, creating, practicing skills, discussion and many others are organized in a systematic manner to attain the pre determined goals and objectives.

Despite the concerted efforts of many classroom teachers, administrators, teacher-leaders, curriculum developers, teacher educators, mathematicians, and policymakers, the interpretation of mathematics teaching and learning in Principles and Standards is not the reality in the vast majority of classrooms, and schools. Evidence from a variety of sources makes it clear that many students are not learning the mathematics they need or are expected to learn (Kenney

and Silver 1997; Mullis et al. 1997, 1998; Beaton et al. 1996 cited in NCTM, 200, p.4). The reasons for this deficiency are many but the quality of mathematics teaching is highly variable (ibid.). To this end, it is known that teachers talk, questioning and answering, textbook or assignment problems can only provide limited help. So it is important to understand what effective mathematics teaching looks like, and what teachers can do to break this pattern. Thus, an active learning approach should be developed and implemented to address this problem in teaching-learning Mathematics. This is because from its nature this method of teaching involves students in the teaching learning process actively and since teaching - learning mathematics needs more students' active participation. Hence, the researcher is initiated(motivated) to do his research on the status and practice of active learning approach in some selected preparatory Secondary schools of Southern Zone of Tigray Region.

1.2.1. Objectives of the study

The purpose of this study was to assess the status and practice of active learning approach in teaching-learning mathematics and to identify those factors affecting the practice of active learning in teaching-learning mathematics in some selected Preparatory Secondary Schools of Southern Zone of Tigray Region. Accordingly, this study was designed to address the following specific objectives:

- To investigate the status and practice of active learning in teaching learning mathematics in Preparatory Secondary School of Southern Zones of Tigray Regional state.
- To examine teachers' and students' Attitudes toward active learning in teaching-learning mathematics in the selected schools under study.
- To identify those factors that influences the practice of active learning.
- To recommend appropriate strategies through which the practice of active learning teaching approach in Preparatory Secondary Schools should be enhanced.

1.2.2. Research questions

This study was designed to answer the following research questions:

- i. What is the status and practice of active learning in teaching-learning mathematics in preparatory secondary school of Southern Zones of Tigray Regional State?

- ii. What are the attitudes of mathematics teachers as well as students towards active learning approach?
- iii. What are the factors that affecting the practice of active learning approach in teaching -learning of mathematics?
- iv. What can be done to enhance the practice of active learning in teaching-learning mathematics in preparatory secondary schools?

1.3. Significance of the study

The major findings of this study make an effort on the current teaching-learning practices in the Ethiopian classroom context. Because the Ethiopian class room context at this moment tries to give high emphasis to students learning. In addition to this the finding of this study has its own role in the quality of education in higher education because from 2009 onwards the Ethiopian Minster of Education has planned to enter 70% of the candidates to higher educational institutions/Universities/ into natural science/technology fields and since mathematics has great contribution for since and technology. Therefore, improvement of mathematics teaching would allow significant effects on promoting the capability in science and technology. More specifically the finding of the study is expected to have the following contributions:-

- It may help mathematics teachers to analyze and select the methods and material in mathematics lesson.
- It clearly pointed out the main problems of teaching-learning of mathematics in preparatory secondary schools of the study area through active learning.
- Find out the teachers' and students' attitudes toward active learning in teaching - learning mathematics.
- Finally, this research can serve as a baseline for further detailed study on issues related to teaching-learning mathematics through active learning.

1.4. Delimitation of the study

It is important to delimit the scope of the study in to manageable size. Hence this study was delimited to four preparatory secondary schools of Southern Zone of Tigray Region out of six preparatory secondary schools in the zone. In addition to this the scope of the study was delimited to focus in investigating the status and practice of active learning and the major factors influencing the practice of active learning in teaching-learning mathematics in the

study area. In generally because the nature of the study as well as subsequent requirements of materials, time and financial resources the scope of the study was delaminated to only grade eleven and twelve students of Southern Zone of Tigray Region preparatory secondary schools.

1.5. Limitation of the study

Among the various problems encountered, the following were the major ones.

- ❖ Lack of seriousness of the respondents in filling the questionnaire, especially students.
- ❖ Information on the practice of active leaning requires repeated assessment on its process for many times but this assessment was more of a one shot process.

Despite these factors the study was easily managed and completed.

1.6. Definition of basic terms

Active learning: refers to any instructional method that engages students actively in the learning process.

Teaching: it is an essential part of education in which its special functions is to impart knowledge, develop understanding and skills (Aggarwal 2001)

Teacher- centered method: the traditional method of teaching in which teachers talk and students listen.

Preparatory schools: refers to grade eleven and twelve.

Practice: repetition of an activity to improve skills/ a method of learning by repetition.

Status: The relative position or standing of active learning.

1.7. Organizations of the study

Generally this Thesis consists of five chapters. The first chapter deals with introduction, which covers; background of the study, statement of the problem, research question, objectives of the study, significance of the study, delimitation of the study, limitation of the study, and definition of basic terms. The second chapter deals with the review of related literature and other related research works. The third chapter contains the research design and methodology. The fourth chapter contains analysis of data, interpretation and discussion of the findings, and the last chapter, chapter five, includes, summary of the findings, conclusions and recommendations based on the findings of the study. The thesis is completed with reference followed by several appendices.

CHAPTER TWO

LITERATURE REVIEW

This chapter presents review of the most relevant literatures and research findings related to the topic under study. So a review of the literature on active learning method would make to support the particular method used in the study for overcoming the problems on the status and practice of active learning in Mathematics class.

2.1. Teaching methods

Teaching is an essential part of education in which its special functions is to impart knowledge, develop understanding and skills (Aggarwal 2001, p.21). Teaching has to consider students' interest that is related to their range of experience, actual events of the country and local reality so as to help them answer questions originating from daily life (MOE, 2009; Mathematics Syllabus, Grades 11 and 12,p.iv). Then it is the behavior of the effective teacher to know what to teach, the content of his subject and how to teach, the method to be applied to the content.

According to Scales (2008,p.121), Teaching methods are often categorized according to whether they are teacher dominated or students centered or tend to be active or passive, surface or deep. But the best thing is to try out various techniques and see if they work. If they don't work, reflect and try to work out why. Along with Aggarwal (2001,p.21) states that effective teacher uses different strategies, tactics or methods depending on their personal talent, the content to be taught, the interests and abilities of the learner. Teaching methods are a means by which a teacher attempts to bring about the desired learning and the way to understand and practice the art of teaching. Aggarwal (2001, p.79-80), note that a method must link up the teacher and his student in to an organic relationship with the constant mutual interaction. Hence the main focus of teaching method is on the effective presentation of the subject matter to have the mastery over it. Teaching methods are generally concerned with the selection, combination and use of various teaching and learning activities, such as discussion, role play or demonstration (Scales, 2008, p.201).

Even though teaching methods are essential and important in teaching learning process there is no such thing as one 'best' of all teaching methods: but what is 'best' is it depends on what instructional learning objectives are being addressed and, at the practical level, on what

are the available resources. Simply we say a teaching method is best if it designed based on the content to be taught (the subject matter in general), the interest and ability level of the child, and if it saves time and energy. From this one can understand that the content, the learner and the mode of presentation determine the teaching method to be used. Therefore, the method of teaching used by the teacher is not simply advice or haphazard collection of techniques modified for communicating a certain item of information to the students, but it must link up the teacher and his students into an organic relationship with constant mutual interaction. Even though this is true the teaching methods vary greatly according to the teacher dose, the educational materials that are used, and what the students do. As a result of this there are different features of teaching methods.

2.2. Classification of teaching methods

People learn at different rates and in different ways (Vygotsky, 1978 cited in Woolf, 2009, p.36). This is way the teaching method should be implemented on the basis of certain criteria like the knowledge of the students, the environment and the set of learning goals decided in the academic curriculum. Students seem to learn more effectively and efficiently when material is customized and individualized (ibid). In general, to achieve the goal of teaching, the teacher must adopt effective teaching methods in education.

Even though there are different classifications of teaching methods such as teacher centered versus student centered method of teaching, direct instruction versus indirect instruction, conventional versus non conventional methods etc the most popular and widely used methods of teaching are teacher centered versus student method of teaching this is why the researcher prefers to see this method of teachings (teacher centered versus student method of teaching) in this part of the review.

2.2.1. Teacher- centered method of teaching

Teacher centered approach usually takes the form of “listen and learn” model (Dejene, et al., 2007, p.119). According to them the teacher maximizes delivery of information and control of the class with little or no involvement of students. In teacher centered method of teaching the teacher is the center of the class room activity while the students are passive listener moreover the teacher is considered as the source of knowledge and the students are recipient of knowledge simply. That means the students participation in deciding on process and purpose

is lowest. In general this method of teaching gives priority role and responsibility to the teacher.

In teacher centered method of teaching emphasis is given to theory rather than to practice and the successful participation of the students who can display their knowledge of facts have been fed into them. This means that the learners are required to display their power of memory and not their skills in the process of that knowledge. The most common methods of teaching which are used in teacher centered method of teaching are lecture, question and answer, and demonstration.

2.2.1. 1.Lecture method of teaching

It is widely and well known method of teaching in transmitting factual information in to a large audience in an economically way through speech. According to Aggarwal (2001, p.116) in education the lecture method refers to the teaching procedure involved in the clarification or explanation to the student of the major idea. It is a mode of presenting word picture of an idea. This method lays emphasis on the presentation of the content. It is one way traffic flow of ideas, the speaker gives ideas and the listeners take them.

The teacher is more active and the students are passive but the teacher use question to keep them attention in the class. In general it can be used to clarify matters, to review the significant details of the lesson as well as to expand contents. Some of the problems with sustained lecturing (Johnson, Johnson and Smith, 1991 cited in Silberman, 2006, p.3; Aggarwal, 2001, p.117) are; audience attention decreases with each passing minute, it tends to promote lower-level learning of factual information, it assumes that all learners need the same information and need it at the same place, there is very little scope for pupil's activity, it does not take in to consideration individual difference, it is against the principle of learning by doing and speed of the teacher may too fast for the learner to grasp the line of taught.

2.2.1. 2.Demonstration method of teaching

At its simplest, a demonstration involves showing other people how to do something; it is the display and explanation of a skill (Scales, 2008, p.130). The demonstration may be of practical/physical skills or of cognitive/intellectual skills. With the help of demonstrative teaching methods in education students get an opportunity to explore the various aspects and

understand of theory from a different perspective. Demonstration is a step-by-step explanation along with their reasons and significance for the better understanding of the student. It implies the presentation of a pre-arranged series of events or equipments to a group of students for their observation (Aggarwal 2001, p.105). It enhances the student's understanding by practically applying the knowledge and sharpens their skills and hence, they become capable of identifying and organizing the subject matter in a more efficient way. Practical experimentation is a very good method used for demonstrating the subject. It is one of the ways which gives students clear understanding of process, skills and how to perform of activities. Therefore demonstration as a practical display or exhibition of a process serves to show or point out clearly the fundamental principles of action involved. It can be used as a useful tool available to the teacher and plays an important role in the teaching of skills.

2.2.1. 3. Question and answer method of teaching

According to Scales (2008, p.148), questioning is the most important skill in teaching and learning. Effective questioning helps learners to develop a fuller understanding of what they are learning and to promote deep and lasting learning. According to Aggarwal (2001, p.139), questioning plays an indispensable part in learning, teaching, and testing. Further he extends his view on questioning as if used in the right way, at the proper time, questions leads to new realms of understanding; they serve as means of organizing knowledge or correlating the result of educative experience; of tying together units of learning; and of integrating personality. By questioning and answering a great deal of instruction takes place between teachers and students. But in lecture class, the question is usually asked by the teacher and the students simply recall what they have been learnt. Ted Wragg's research (1984) cited in Scales (2008, p.149) suggests that teachers in schools ask up to 400 questions a day, which represents about 30 per cent of their total teaching time. However, only about 8 per cent of these could be considered as higher- order questions, that is, questions which stimulate, for example, thought, analysis and evaluation. The majority of questions by far were concerned with management and control issues ('are you listening?') or recall of information ('who was Juliet's boyfriend?'). The teacher use this method of teaching since it is believed that questioning is serves as a means of organizing knowledge or correlating the result of educative experiences. Furthermore, it serves to test the previous knowledge of the student to enable them to recall, organize, think, reason, stimulate interest and efforts on what they

have learnt, and to promote students mental activity and to involve the learner as collaborators in the instructional process.

2.2.2. Student /child -centered method of Teaching

Now a day there is a quest among educational specialties to move from the traditional method of teaching, teacher centered, to modern method of teaching, student centered method of teaching (Aggarwal, 2001, p.64). According to Westwood (2008, p.27) student-centered methods are deemed best practice in situations where the teaching objectives for the lesson include acquisition of independent study skills, greater student autonomy, working collaboratively with others, the construction of knowledge from firsthand experience, and the application of basic academic skills for authentic purposes. Most student-centered methods are concerned not only with knowledge construction but also the development of effective learning strategies, often encompassed by the expression 'learning how to learn. In general according to O'Brien, et al. (2008, p.32) a learner - centered approach asks to what extent the teacher can support and challenge students to assume responsibility for actively shaping their learning in his course and in future courses with the understanding that they will be learning independently throughout life. The student is considered to be responsible for his learning and much of the responsibility for learning is put on the student (Dejene, et al., 2007, p.120). In this method of teaching students are not passive recipient of knowledge and information from the teacher and text books but they are active learners in their learning process. In student centered teaching approach the curriculum is constructed according to the pupils' interest and need (Aggarwal, 2001, p.64). He also further stated that out of the three component of learning situation; the child, the teacher and the environment; pride of place is to be given the child. Thus this learning model places the student (learner) in the center of the learning process.

Student-centered methods of teaching dose not reject the impertinence of the teacher in the teaching learning process. According to Aggarwal (2001, p.64) the teacher in child centered method of teaching provides students with opportunities to learn independently and from one another and coaches those in the skills they need to do so effectively. That is teacher's role is to help the child in which to conform its unique role, both in its spirit, habitual values, choices and consistent behavior patterns (ibid). Hence the teacher should create opportunity for learning and encourage learner's independency, organize activities through which students

will gather or use information, make sure students are really thinking and analyzing, accepting and encouraging student's feeling and ideas, and checking their progress to make sure that all students are learning. The central issue of learner centered method of teaching is to foster reflection, autonomy, active learning and the degree of students learning.

According to Bruner's theory of instruction (1966) cited in Stringer, et al. (2010, p.19-20) in learner-centered method of teaching the instruction should be:

- ❖ Concerned with the experiences and contexts that student environment is planned for (readiness and ability to learn).
- ❖ Structured so that it can be easily grasped by the student (spiral organization).
- ❖ Designed to facilitate extrapolation and/or fill in the gaps (going beyond the information given).

Since the means of learning in student-centered method of teaching is the activity under taken by the learner and since the learners learn best when they are actively involved in the teaching learning process. Then it is important to create a conducive learning environment for the child in order to be actively participating in the teaching learning process. In addition to this since the student centered method is based on the needs, interests and abilities of the learner in which the teacher's role is that of facilitating in teaching learning process. Then the instructions should be designed based on different teaching strategies and hence active learning approach is the main idea in learner centered method of teaching. Thus the different features of active learning will be shortly discussed in this part of the review.

2.3. The concept of active learning

Traditional teaching methods have focused on the lecture-based approach in which students are passive recipients of knowledge. According to Song and Kidd (2010) in traditional teaching methods students rarely interact with other students or the instructor and hence the education process is simply information transfer. That is students memorize the content from the classroom and restate it for the purpose of taking tests or exams (Song and Kidd, 2010, p.108). These passive learning problems caught the attention of some educators who have been trying to find solutions to engage students in the process of learning, and to shift learning to student side through classroom interactions, activities, group projects, classroom discussion

bulletin, collaborative learning, different assessment format and effective use of classroom technologies (ibid). According to Silberman (2006, p.2) in order for people to learn something well, they must hear it, see it, question it, discuss it with their peers, and do it. They might even teach it to someone else in order to solidify their understanding of the information or skill. An active approach to training requires a variety of strategies that promote all six processes, hearing, seeing, questioning, discussing, doing, and teaching.

Further Silberman (2006, p.2) consider the following three statements. According to him among these statements there was a Confucius between different educators for over twenty-four hundred years ago.

What I hear, I forget.

What I see, I remember.

What I do, I understand

But he has modified and expanded the wisdom of Confucius into what he calls the Active Learning Credo:

When I only hear, I forget.

When I hear and see, I remember a little.

When I hear, see, and ask questions and discuss with someone else, I begin to understand.

When I hear, see, question, discuss, and do, I acquire knowledge and skill.

When I teach someone, I master what I have learned

Finally he stated that these three simple statements speak volumes about the need for active learning and active learning/training occurs when the participants do most of the work. Thus active learning approach is one of the mechanisms to make the teaching learning process is more interactive.

According to Newmaster et al. (2006) as cited in D'Silva (2010, p.77), active learning involves learner-centeredness that "places the student in the driver's seat". Learner centeredness maximizes student learning by an "authentic learning" mechanism that directly engages the student through intrinsic inquiry allowing the student to take ownership in the products of his or her education if they are applied to the benefit of others in socially conscientious ways (ibid). In addition to this according to Mills (2006, p.4) for students to learn, they must do more than just listen to a lecture or a presentation from a teacher, they

must do something and think about what they are doing. Further Mills (2006) argue that active learning occurs when instructional activities involve students in doing things and thinking about what they are doing. Therefore active learning refers to techniques where students do more than simply listen to a lecture. That is it keeps students towards love for learning and helps them to develop integrative reasoning. But it has been a challenge for teachers to engage students in active learning, especially in large lecture classes.

Strategically designed active learning is critical for the overall development of students towards life-long learning D'Silva et al. (2009) as cited in D'Silva (2010, p.77). By active learning, students not only become engaged with the ideas being communicated among themselves, and between the students and the instructor, but also process the information acquired, integrate the newly acquired information with their prior knowledge, retain the integrated information over time and subsequently transfer their learning to new situations. According to Bonwell and Eison (1991) cited in Song and Kidd (2010, p.107-108) "the strategies promoting active learning are defined as instructional activities involving students in doing things and thinking about what they are doing". The basic elements of active learning are talking, listening, writing, reading and reflecting (Meyers & Jones, 1993, *ibid*). They also suggest that active learning is derived from two basic assumptions: (1) learning by nature is an active endeavor and (2) that different people learn in different ways.

The major characteristics associated with active learning are summarized by Bonwell and Eison (1991) cited in (*ibid*, p.107) as: 1) students are engaged in learning activities instead of passive listening; 2) instruction emphasizes the development of student skills rather than just the transmission of information; 3) students are involved in higher order of thinking and receive immediate feedback from the instructors, and 4) greater emphasis is placed on the exploration of attitudes and values to increase student motivation in learning. From these characteristics, we can easily see that active learning is shifting the balance from teacher-centered, lecturing, to student-centered learning. Students learn to a greater depth of understanding when they are actively involved in the process through activities, interaction with other students, critical thinking and increased learning motivation.

Active Learning is, in short, anything that students do in a classroom other than merely passively listening to an instructor's lecture. This includes everything from listening practices which help the students to absorb what they hear, to short writing exercises in which students

react to lecture material, to complex group exercises in which students apply course material to "real life" situations and/or to new problems (Paulson & Faust, California State University, Los Angeles, [http:// www.calstatela edu/dept/chem/chem2/Active/index.htm](http://www.calstatela.edu/dept/chem/chem2/Active/index.htm). Therefore the core elements of active learning are student activity and engagement in the learning process.

Active learning is not only emphasizes the development of students' skills but also their exploration of their own attitudes and values. Thus active learning is often contradicted to the traditional lecture where students passively receive information from the instructor. But it is important to remember "Active learning does not diatribe against lecturing" (Meyers & Jones, 1993, cited in Song and Kidd, 2010, p.107). According to Song and Kidd (2010, p.107) quality lectures are absolutely necessary in guiding students in their learning of new knowledge through enlightening important concepts and providing examples for further understanding. The key issue here is what students should do with the lecture materials, mechanically memorizing or digesting content through various activities for thorough understanding. Therefore lecture does have its place and that any one should not do active learning without content or objectives.

Active learning includes collaborative learning (students work together in small groups towards a common goal), cooperative learning (students pursue common goals while being assessed individually), problem-based learning (relevant problems are introduced at the beginning of the instruction cycle and used to provide the context and motivation for learning that follows), inquiry learning and discovery learning (Prince, 2004 cited in silva, 2010, p.78, Mills, 2006, p.28, Westwood, 2008, p.26).

2.3.1 .Problem-based learning

Problem-based learning is a form of active learning where students start by facing on a valid problem that needs to be solved and then determine what they need to learn and understand in order to solve the problem. According to Aggarwal (2001, p.245) problem solving is an instructional method or technique whereby the teacher and the pupils attempt in a conscious, planned and purposeful effort to arrive at some explanation or solution to some educationally significant difficulty. In order to find a solution, students must draw on their knowledge, and through this process, they will often develop new mathematical understandings. This approach strongly centers on the learner, who must recognize what they need to know, access

that information, develop a firm understanding of fact, concepts, and methods, and then apply all of these to solving the problem.

According to NCTM (2000, p. 52) Problem-solving is considered as the heart of mathematics learning because the skill is not only for learning the subject but it emphasizes on developing thinking skill method as well. Students can apply their knowledge and problem solving skills to be useful in daily life since the processes of solving the mathematic problem are similar to the general problem solving. Solving problems is not only a goal of learning mathematics but also a major means of doing so. By learning problem solving in mathematics, students should acquire ways of thinking, habits of persistence and curiosity, and confidence in unfamiliar situations that will serve them well outside the mathematics classroom (ibid). Generally Problem solving ability enables the learner to find appropriate solutions to problems which confront him.

The teacher's role in problem based learning (Aggarwal, 2001, p.248) is to:

- Get the learner to define the problem clearly
- Aid them to keep the problem in mind
- Get them to make many suggestions by encouraging them,
- Get them to organize the material by proceeding
- Get them to evaluate each suggestion carefully by encouraging them.

2.3.2 .Collaborative learning

Collaborative learning refers to any instructional method in which students work together in small groups toward a common goal. It is one of the most valuable educational approaches in terms of improved learning outcome (Woolf, 2009:317). It invites students to work on parts of problems with teammates and to discover things for themselves (ibid). Students may work face to face and in or out of the classroom, or they may use information technology to enable group discussion, or to complete collaborative writing tasks. Collaboration is a process that gets people working together in new ways (Winer and Ray, 1994 cited in Alan, and John, 2010, p.27). Collaboration enhances a teacher's role as advisor and, when successful, supports structural and institutional changes that move classroom activities from teacher-centered didactic instruction to student-centered inquiry (O'Neil and Gomez, 1994; Slavin, 1990b; Suthers and Weiner, 1995; Suthers et al., 1997, 2001cited in Woolf, 2009, p.318). The heart

of collaboration is the single goal being pursued by two or more learners (Alan, and John, 2010, p.27). As such, collaborative learning can be viewed as encompassing all group-based instructional methods, including cooperative learning (Prince, 2004 cited in D'Silva, 2010, p.1). The core element of collaborative learning is the emphasis on student interactions rather than on learning as a lonely activity. It emphasizes structured or formal collaborative work, positive interdependence (of task, identity, role, and goals), individual and group accountability (challenging and motivating every student), and authentic interaction (brainstorming, planning, social and team building skills, and solidarity) (Woolf, 2009, p.317).

Collaborative learning, like problem-based learning, emphasizes student-centered tasks and student decision-making by:

- ❖ encouraging a focus on student-centered learning and the development of lifelong transferable learning skills
- ❖ providing an alternative to the individual, competitive model of learning, fostering teamwork and the development of interpersonal skills
- ❖ encouraging a smoother transition to university
- ❖ Developing generic skills needed to satisfy employer expectations.

2.3.3. Cooperative learning

Cooperative learning is the instructional use of small groups to maximize individual and group learning (Johnson, et al., 1990 cited in Mills, 2006, p.156). It is a set of processes that help people interact to accomplish a specific goal or end product. Compared to collaborative learning, cooperative learning entails more structure and teacher direction and is more appropriate with well-defined, well-structured problems. The National Council of Teachers of Mathematics (NCTM, 2000) recommends that students must be provided opportunities to work together cooperatively in large and small groups on significant problems, problems that arise out of their experiences and frames of reference. Students should question, discuss, make mistakes, listen to the ideas of others, provide constructive criticism and summarize discoveries (ibid). Generally cooperative learning is an instruction that involves students working in teams to accomplish a common goal.

The terms 'co-operative learning' and 'collaborative learning' are often used interchangeably but, according to some authors, there are major differences between the two (Bruffee 1995; Panitz 1997; Roschelle and Teasley 1995 cited in Gillies and Ashman, 2003, p.71). Cooperation and collaboration in the classroom are distinctly different phenomena, but they are inextricably connected (Alan, and John, 2010, p.26). Co-operative learning is considered to be the most structured approach to learning in groups while collaborative learning is less structured (Panitz, 1997 cited in Gillies and Ashman, 2003, p.71). In co-operative learning, the structure is imposed by the teacher (Abrami et al. 1995, *ibid.*) and is designed to achieve a specific goal or endproduct (Panitz 1997, *ibid.*). Collaborative learning represents a different philosophy of interaction whereby students are given more power over their learning than in traditional instruction (Abrami et al. 1995, *ibid.*). Bruffee (1995) proposed that co-operative learning is more appropriate for use with elementary schoolchildren while collaborative learning is better suited for adults including college and university students(*ibid.*). With cooperative learning, it is assumed that elementary schoolchildren do not have the social skills required to work effectively together (Matthews et al. 1995, *ibid.*). In collaborative learning, it is assumed that the students already have the necessary social skills and the motivation to reach their joint learning goals (Matthews et al. 1995, *ibid.*). The interdependence of collaboration and cooperation can be summarized as follows: without cooperation no collaboration can take place; the expectation of collaboration fosters cooperation (Alan, and John, 2010, p.27).

2.3.4 .Inquiry learning

Inquiry-based learning challenges and motivates students to investigate and learn, using real-world or relevant questions and focusing attention on creating solutions (Mills, 2006, p.175). With inquiry-based learning students formulate investigative questions, obtain factual information, and then build knowledge that reflects their answer to the original question (*ibid.*, p.30). More over through inquiry learning students learn which questions to ask and how to make predictions from theories, test theories, and derive theories from data (Woolf, 2009, p.299). Inquiry learning assists students to identify their existing knowledge of a topic or issue, and develop new knowledge from that foundation (Sunil & Haas, 2008, cited in Stringer, Christensen and Baldwin, 2010, p.4). This means the learner's use their mined in

logical and mathematical ways to organize and internalize concepts and principles of the world.

With inquiry methods the teacher supports students by questioning and guiding them in their investigations (Mills, 2006, p.176). Refinement of ideas takes place through discussion and debate. Thus, the questioning and facilitating skills of the teacher are important to the success of the inquiry approach. Teachers must challenge students to form their ideas and explanations precisely, basing them on legitimate and credible facts and information (ibid). The teacher does not tell the students what they will learn, but assists them to extend their knowledge in ways that are meaningful to them.

According to Mills (2006, p.176) the advantage of inquiry learning is that it permits students to investigate engaging and authentic topics and generate new knowledge and understandings. It moves students toward deeper understanding of a topic by allowing them to organize, analyze, synthesize, and assimilate information using higher order thinking skills. They can then generate new ideas about the topic and present these ideas for further scrutiny by peers, teachers, or experts. The ability to inquire and utilize appropriate resources also helps students learn to solve unstructured or ambiguous problems or questions (ibid).

2.3.5. Discovery learning

Discovery learning is perhaps the best-known form of inquiry-based learning (Westwood, 2008, p.28). Discovery learning is an inquiry-based learning method that encourages students to discover for themselves the rules, relations, or concepts about something (Mills, 2006, p.176). It requires students to investigate a topic, issue or problem by active means, obtain pertinent information, interpret causes and effects where relevant, and arrive at conclusions or solutions (Ormrod, 2000, ibid). The method is particularly appropriate for achieving important objectives in social studies, science, geography, history, health, environmental education and mathematics (ibid). According to Mills (2006, p.30) discovery learning uses questioning strategies to engage students in discovering rules and relationships and generating new knowledge and understandings. With this approach students are required to discover the rules behind concepts. The role of the teacher is shifted from presenting subject matter to activating conversation to encourage students to discover answers or solutions. The teacher coaches

students by questioning, provides context to the topic, draws upon students' prior and prerequisite knowledge, gives feedback, and provides help(ibid).

The general consensus regarding discovery learning is that it is most effective when (Westwood, 2008, p.28):

- the process is carefully structured
- students have prerequisite knowledge and skills
- Teachers provide any necessary support during the investigations.

2.4. Active learning in Ethiopian context

The New educational Training policy (1994) of Ethiopia leads to an extensive change in education in Ethiopia. According to Leu (1998) cited in Takele (2008, p.29) one of the changes is the paradigms shift in the model of teaching and learning which involves the shift from rote learning to active learning, and the shift a linear to an integrated curriculum. This change brought a major paradigm shift in our thinking about education and in the meaning of knowing and learning. Generally, the major change in the Ethiopian curriculum reform enhances the shifts from traditional passive and rote learning to new model of participatory and active learning approach. In other words the shift is from learning through memorization and repeated information to learning through problem solving, discovery learning, analyzing and evaluating to create new knowledge and understanding.

Then after the approval of the Education and Training Policy (1994) the subsequent school curriculum focuses on the modern method of teaching that propagates active learning strategy. According to Ambaye(1999) cited in Takele (2008, p.30) in Ethiopia the new curriculum at school is now underway and calls for emphasis on intellectual stimulation, practical applications and active learning, this implies that the curriculum development and instructional materials which were based on teacher centered method in the past and instructional methods which were dominated by passive learning which encourages pouring of information in the mind of the learner is being changed.

According to the Educational and Training policy of Ethiopia (1994, p.7) education will be directed towards the development of “physically, mentally, and the problem solving capacity of individuals.” This shows that active learning methods are given high emphasis than before or

at this day in Ethiopia. From this one can understand that the teaching-learning process in Ethiopian educational system is required to be active. Because active learning is characterized by problem solving, student participant, and inquiry oriented teaching learning process/strategy. Therefore, in Ethiopian education context there is a tendency to promote and develop students' cognitive abilities and problem solving skills which are among the major educational goals stated in the educational and training policy (1994) of Ethiopia. Hence, it is important to see the practice of active learning in Ethiopian Educational System in order to empower learners in the teaching learning process of the country.

2.5. Factors influencing the practice of active learning

People play a key role in implementing any new change in particular in educational system. However, people are not usually ready to accept and implement the new changes. According to Derebssa (2004, p.236) this resistance may occur due to self interest, misunderstanding and lack of trust in the change. Then for effective implementation of the new change for example active learning there should be a positive attitude and sounded knowledge and skills in the area. In contrast to the importance of making students active in class room learning, the majority of the students plays a relatively passive role in the classroom and see themselves as a recorder of the information transmitted by the teacher Becker, Geer, and Hughes (1994) cited in Hativa (200, p.88). A major reason for this is the resistance found among teachers to use active learning methods. According to Hativa (200) there are three main barriers that teachers resist active learning approach. These are:

- ❖ **Waste of time:** some teachers claim that they need to cover the curriculum material and do not have time to waste on students activities in class.
- ❖ **Lots of control:** other teachers are concerned about the risk of uncertainty, losing control, and chaos in the classroom if they use active methods extensively during the lesson, particularly in large classes.
- ❖ **Unprepared students:** some teachers justify their audience of active learning methods that are based on assigned reading or other homework by arguing that students come unprepared.

Even though there are a number of factors which affects the practice of active learning the researcher tries to categories in to three major factories such as those factors which are related teachers, student and schools.

2.5.1. Teacher related factors

According to Aggarwal (2001, p.89) teachers will teach in the way they were taught themselves and not in the way they were told to teach. Similarly Bruner (1996) in Takele (2008, p.33) mentioned about the general area of teachers competence related to the component of theoretical knowledge about learning and human behavior, mastery that required practical application in concert simulation, curricular arrangements, and knowledge of general and specific method of teaching. This is because theoretical knowledge can be use to interpret situation and solve problems. Further he stressed that the quality of teaching has directly relation with teacher's extensive training and repeated exercise. Therefore, the way teachers trained can strongly affect the whole educational process particularly in the implementation of active learning, because teacher's role in the implementation of active learning is high.

According to Tilahun (2002, p.74-75) if teachers are properly trained and implement the skills they acquire in their professional career, they are likely to influence their students. That is in teachers training, the knowledge and skills teachers acquire enable them to help their student, rather than forcing, in giving relating materials in class to the student/learners experience and social needs recognizing individual needs pupil's, cooperating with the whole staff members in solving school problems. Myer and Gayle (1996, p.43) argued that secondary school teachers must be well educated and competent in their professional skills. Similarly MOE (1994) identifying the learner centered in the general objectives of teacher education which includes:

- ❖ Preparing teachers who can select and use appropriate teaching material, choose, produce and make use of local resources to enrich students learning,
- ❖ Preparing teachers who can confidentially promote active learning and the development of problem solving skills through learner centered approach using the curriculum where content and methods are integrated,
- ❖ Produce teachers who are academically qualified, professionally skilled, attitudinally and ethically committed to their profession,
- ❖ Equipping teacher with knowledge and ability in the class room management, which fosters contractive student inquires and interactions

Thus, if teachers are trained in line to the above educational objectives which are stated by MOE then active learning approach can be implemented easily as intended otherwise not. Generally to implement/practice active learning approach it needs academically qualified and professionally prepared teachers.

2.5 .2. Student related factors

Active learning methods encourage student's autonomous learning and problem solving skills. It provides peoples with grater personal satisfaction, more interaction with peers, promotion of share activates and team work, greater opportunities to work with range of peoples and for all members of the class, to contribute and respond (Capel, et al, 1995 cited in Lemma, 2006, p.). Despite our best intentions, active learning can work poorly in the classroom if students do not understand why they are learning this way (Takele, 2008, p.33). Along with Felder and Brent (1996) cited in Weimer (2002, p. 150) make the fundamental point about student resistance very clearly: *"It's not that student centered instruction doesn't work when done correctly—it does, as both the literature and our personal experience . . . richly attest.* If students have not previously used active-learning strategies or if the active-learning strategies are not designed in such a way that students con master it easily then they may be feared and aggressive by the progressive teaching approaches. Therefore, the students; whose teachers have been telling them everything they needed to know from the first grade on; don't necessarily appreciate having this support suddenly withdrawn" (Weimer; 2002, p. 150). According to Weimer (2002) Students resist active learning/student centered approaches for a variety of reasons. Some of the most common reasons that students may resist in practicing of active learning approaches are since it requires more work, it is time consuming, it involve losses(i.e. whenever one move from one level of understanding to another there may be a lost something), and it may be beyond students capacity.

Generally the major reasons for student resistance to active learning approach is that since in active learning situation the teacher may give students group work or individual tasks which require application of concept that may note done by simple rote memorization(Takele,2008, p.34). Such context may force the student to exert more effort on what they are doing. Due to this students may view active learning as something extravagance. This may lead to students to have negative attitude towards active learning.

Even though, there may be some resistance to active learning by students who are accustomed to lectures, students who prefer passive learning, or students in large classes. A teacher should prepare his or her students by explaining his or her objectives and by telling the benefits of active learning techniques explicitly to students and by asking them for feedback on the activity which is not clear to them in order to improve it for the future. Moreover it is important students to know why the teacher teaches them in the way that he/she does. That is they should know what are the teacher's goals are for the course and understand how the teacher plan to help them achieve mastery of those goals. This is because the students' role in implementing/practice active learning is very important. Therefore, it is necessary to encourage and develop interests in students in order to make practical to the method of teaching.

2.5 .3. School related factors

According to Danielson (2006, p. 84), a school is only as good as the instructional program it offers to its students and the results it obtains. While school wide policies and programs set the stage for the instructional program, the real magic of education happens every day in every classroom. Further she extends his argument to be sure that a successful school is one that delivers a superior instructional program to its students, and the heart of that program is teaching and learning. School's approach to teaching and learning involves several interrelated aspects: a focus on results, curriculum, assessment, and teaching. Teacher leaders make material contributions to improvement in all these areas (ibid). Then the support of the school management is very important in performing effective learning in class rooms. Kitson and Merry (1997, p.164) explained that effective learning is active rather than passive, covert rather than overt, complex rather than simple, affected by individual differences among learners, and influenced by a variety of contexts. This implies that teaching-learning should be active. But there are different factors that affect the practice of active learning like nature of class room, class size, shortage of instructional materials, and others. Hence, the school administration should have high responsibility in supervising and supporting staff members methodologically and materially in order to have effective learning/ active learning approach in the school.

Among the various factors that can be affect active learning the nature of class room is one of the most important factors that can affect in the teaching learning process. According to

Weimer (2002, p.99) in the physical world, the atmosphere, environment, and climate exert powerful influences on our behavior. She further states that classroom environments affect behavior, including the motivation to learn and the willingness to accept responsibility for learning, in the same pervasive and significant ways. We sometimes teach unaware of these forces or we take them for granted, but if the “weather” ever turns nasty in a class, we quickly learn how powerfully classroom climate can influence attitudes and actions(ibid.). Therefore, the nature of class room is one of the most important factors that should be considered in teaching learning process particularly in Ethiopian context. In line to this Temechen (2001, p.41) said that the physical layout of class room in Ethiopian school is mentioned as a factor that is not conducive to learner centered methods.

Another factor that influences the teaching learning process particularly in Ethiopian context is the crowdedness of class room. Educators in Western countries generally consider classes of over thirty five students to be large and to present difficult challenges to achieving instructional goals (Bennett (1996) cited in Gillies and Ashman, 2003, p.210).This problem affects student participation, teacher student interaction and feedback in the class room. Due to this teachers try to teach their students at the same time by lecturing. Though for the effective implementation of active learning the number of students in a class must be optimum.

Instructional materials are also other factors that influence the teaching-learning process in particularly in mathematics through active learning approach. According to Mukalal(1998) cited in Amenu Oljirra(2005, p.137) instructional materials(IM) are those materials that the teacher brings in to the class room from time to time to facilitate his/her teaching and to make the work more creative and effective. From this it can be seen that introducing teaching aids to the class room helps to add a new dimension to teaching .On the other hand according to Mukalal(1998) most of the teachers shrink away from the use of teaching aids chiefly because the teaching aids have unique problems of their own such as 1) the preparation of the aids or procurement/buying including their cost 2) presenting these aids including cumbersome /unmanageable manifestation 3) procuring/acquiring these for specific class room purpose. In general the problems in IM may include shortage of text book, teachers guide, syllabus, pedagogical centers, library, reference books, laboratories, computer services

etc. Then the presence or the absence of these materials may facilitate or hinder the practice of active learning in mathematics.

Generally the physical environment of the school like class room arrangements, class size, classroom appearance and layout, class room facility and furniture arrangements has their own impacts to encourage active learning approach.

2.6. The design of safe active learning environments

Learning is essential for all living creatures; people and animals adapt to their environment, modify their behavior to survive, and learn from experience. *Tom Mitchell (1997) cited in Woolf (2009, p.224) states that Humans learns many tasks over a long lifetime and seems to use the accumulating knowledge to guide subsequent learning. One interesting direction . . . is to develop long-life agents that accumulate knowledge and reuse it to guide learning in a similar fashion. These agents might learn new representations, as well as facts, so that they can more effectively represent and reason about their environment as they age.* This is why the way we plan the instruction has an effect both on what has been learnt and on how an individual will use the things he/she has learnt. For this reason, teaching-learning process includes selection, arrangement transferring knowledge in a proper environment and interaction between this information and the individual. Hence learning environment means not only the place that instruction will occur but also the methods, instruments, equipments, and materials which will be used in transferring the knowledge and guiding the works of individuals in learning process (Demirel, et al., 2003 cited in Uyangör and Karaca, 2010, p.213).

According to Hughes (2009, p.2) an effective mathematics learning environment is one in which students and teachers interact in ways that allow students to have an opportunity to maximize how much they learn. There are a variety of ways in which students and teachers interact in a learning environment. Some interactions result in student learning, however, others have very little effect on student learning. According to Motani and Garg (2002) cited in (ibid, p.3), a successful learning environment is one in which students and teachers interact easily, continuously and without any inhibitions. In this type of learning environment, student learning is not left to chance; rather, teachers know whether their students understand intended concepts. The key to this success is the implementation and use of an instantaneous feedback system. Instantaneous feedback enables teachers to intervene immediately when

students misunderstand a concept or principle which is important in meeting the learning objective.

On the other hand, there are instructional strategies in which students sit passively in classrooms where there is one-way communication, from teacher to students. One experience shared by most students is the passive learning environment that characterizes much of current schooling (Michael, 2003, p.71). In these learning environments, they were required to demonstrate only that they assimilated information that was disseminated in class. As a result, they became adept at organizing information in formats that are conducive to memorization but are not necessarily appropriate for building the integrated conceptual models necessary for analyzing scientific problems. In other words, they were not required to engage in meaningful learning. But the active learning environment will not flourish if students do not accept responsibility for their own learning and participate in the learning environment in an appropriate way.

Hughes (2009, p.2) argue that Creating an interactive (safe) learning environment inside the mathematics classroom in which students are engaged in mathematics learning can be challenging. The challenge is not necessarily in knowing what to do to make the environment safe, it is in doing the things that promote safety. Students may experience discomfort about their own level of mathematics content knowledge and may shy away from participating openly in class discussions or responding to teachers' oral questions. Further, the complex negotiation of teacher talk, student talk, and classroom dynamics while remaining on-task requires certain skills and know-how. When these dynamics work well, the result can be the creation of a learning environment in which critical thinking and quantitative reasoning develop, student learning succeeds, and students take increasing responsibility for their own learning (ibid).

According to Michael (2003, p.71) establishing and maintaining a safe environment is a continuing process. He further explains that efforts must begin at the first meeting of the class and continue throughout the course. Although the exact path to establishing safety in the classroom depends, in large measure, on the individual instructor, the issues that the path must address are common to all classrooms. The aim of an active learning environment is to maintain and encourage students' motivation to learn, to make them feel confident and

ambitious during their studies. In relation to this findings from contemporary research on cognitive and social issues in learning suggest that four important characteristics of powerful learning environments that are critically important for achieving learning with understanding (O'Neil, 2003, p.128). These are effective learning environments are knowledge centered, learner centered, assessment centered, and community centered.

Generally a powerful learning environments consists four principles for the design of instruction within such a contextual perspective (O'Neil,Jr., 2003, p.129):

1. To establish knowledge-centered elements of a learning environment, instruction is organized around meaningful problems with appropriate goals.
2. To support a learner-centered focus, instruction must provide scaffolds for solving meaningful problems and supporting learning with understanding.
3. To support assessment-centered activities, instruction provides opportunities for practice with feedback, revision, and reflection.
4. To create community in a learning environment, the social arrangements of instruction must promote collaboration and distributed expertise, as well as independent learning

2.7. Active learning and conceptual understanding of mathematics

According to NCTM (2000, p.21), the major goal of school mathematics programs is to create autonomous learners, and learning with understanding supports this goal. Further the document elaborates that students learn more and learn better when they can take control of their learning by defining their goals and monitoring their progress. Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge (ibid.). This shows that students who memorize facts or procedures without understanding often are not sure when or how to use what they know and such learning is often quite fragile. On the other hand learning with understanding makes learning easier in particularly in mathematics. In short conceptual understanding is an essential component of the knowledge needed to deal with different problems and settings. In line with this, Pundak, et al. (2009, p.216) argue that a wide range of evidence supported the concept that in active learning students achieve higher conceptual understanding compared to other students who studied the same courses according to the traditional learning approach.

Hence, one of the most significant aims of active learning approach is to develop high level thinking skills. Etkina and Van Heuvelen (2001) argue that students are asked to solve problems according to the scientific method. That means they collect, analyze, interpret and represent data, and relying on this procedure they design a system, component, or process to meet desired needs (ibid). Most researchers found that in active learning the students advanced from questions at a low thinking level such as “how to calculate?” or “what is my mistake?” to a higher level of thinking such as “why does it work this way?”, “what is the reason for this procedure?” or “where can we find the same patterns?” (ibid). This indicates that the students understood the importance of theory as a key to understanding mathematical principles. They also internalized the importance problems of general concepts and their contribution to effective solutions of various mathematical concepts. Therefore, teaching mathematics according to the active learning approach enhance student thinking skills, for example, asking questions and conceptualizing answers.

2.8. Active learning strategies in mathematics class rooms

Active learning is an effective teaching strategy that is used to engage students with contents that develop competencies and build skills rather than acquisition of knowledge alone. In recent years, mathematics educators have increased the use of active learning strategies in mathematics class rooms as endorsed by Meyers and Jones (1993) cited in Ahmadi (2002, p.107) who wrote: “ A growing body of research today points to active learning strategies, in which students talk and listen, read, write, and reflect as they become directly involved in the instructional prose, as a way to better engage students, cultivate critical thinking, and improve the overall quality of teaching and learning” .

Mathematics teachers can use several strategies to get and give feedback about how well students are learning material that is being taught. Motani and Garg (2002) cited in Hughes (2009, p.3) observed that there are different mechanisms for getting feedback such as class discussions, cooperative group work, board-work, seat-work or answering questions that are posed orally. Under the standards of pedagogy “ interactive and collaborative learning mathematics will foster interactive learning through student writing, reading, speaking, so that the students can learn to work effectively in groups and communicant about mathematics orally and in writing. Class discussions are a good example of how an interactive strategy can work for some, but not all students (ibid). Silverthorn (2006), professor of physiology, in

Hughes (2009, p.3) noted that, “There was always a group of students, usually sitting at the front of the room, who would answer questions and talk to me as if we were chatting in my office, while the remainder of the class sat passively at the back of the room and listened and took notes”. The students who sat at the front of the room benefited from the verbal interactive exchange with the professor. The students in the back of the room did not benefit from the exchange of information about their learning with the professor. Therefore, in order to engage more students in the interactive activities in the class, Silverthorn (2006) suggests that teachers must employ more student-talk, less teacher-talk and more class time for problem-solving activities.

To sum up, there are several strategies to help students while they involve in actively learning:

- ❖ *Modeling*: The teacher demonstrates how to use a tool. He gives a *worked example* to the students. To make the example more elaborate, he explains what he intends to do and which strategies he uses. In addition, he can begin to demonstrate, but does not solve the whole problem. This kind of instruction is also known as *completion problem*. It can be used to activate students by giving them a context from where they can start.
- ❖ *Coaching and scaffolding*: The teacher helps students when they run into problems, or when they have a question. He also offers a learning environment with a reduced complexity to support novices in exploring and discovering.
- ❖ *Discussing*: The teacher gives feedback on the students’ solution processes and gives hints how they can perform better. He also encourages the students to discuss their solutions and solution processes with their peers.

In active learning teachers generally take the role of facilitator, supporting pupils as they learn and develop skills in, for example, assessing evidence, negotiation, making informed decisions, solving problems, working independently and working with others.

CHAPTR THREE

RESEARCH METHODOLOGY

This part elaborates on the method; which refers to the actual and detailed procedures and techniques for participant selection, data collection, data analysis, and reporting; that would be used to conduct the present study that deals with the status and practice of active learning in teaching-learning mathematics in some selected Preparatory Secondary Schools of Southern Zone of Tigray. And it begins with the presentation of the overall design and the procedures followed by giving an explanation of the data sources, data collection and data analysis procedures.

3.1. Overall research design

According to Scott and Morrison (2005, p.58-59), research design refers to the schema or plan that constitutes the entire research study. It includes research method or research strategy, sampling design, choice of research tools, and choice of statistical techniques (Singh, 2006, p.77). That is, it is a sequence of events which connects the procedure for collecting the practical data to the original research questions.

As it is stated in the introduction part of this paper the major purpose of the study was to assess the extent to which the status and practice of active learning in teaching learning mathematics and to identify those factors affecting it in teaching-learning mathematics in some selected Preparatory Secondary Schools of Southern Zone of Tigray. Then in order to have clear picture about the status and practice of active learning in teaching-learning mathematics the descriptive survey method was employed. Descriptive survey method helps to have general understanding of the problem by studying the current status, nature of preventing conditions, practice and trends through relevant and precise information (Koul, 1996 cited in Gebeyaw Teshager, 2007, p.44). It is concerned with the present and attempts to determine the status of the phenomenon under investigation (Singh, 2006, p.104). Therefore, it enables the researcher to identify the existing implementation factors which needs to be improved so as to enhance the practice of active learning in the study area. In addition to this the researcher used qualitative method to gather qualitative data from his respondents.

3.2. Population and subject of the study

The populations of this study were both students and mathematics teachers of preparatory secondary schools in Southern Zone of Tigray Regional State. There are six preparatory secondary schools in this zone. Then the researcher has taken four of them as the subject of the study.

3.3. Data source, sample size and sampling techniques

3.3.1. Data source:

Both primary and secondary data were used for the study. Primary source of data were obtained from preparatory school mathematics teachers and students through questionnaire. Moreover, data were obtained from four head department of mathematics teachers of preparatory secondary schools through interview. Secondary data were obtained from relevant documents prepared by the Ethiopian Ministry of Education like mathematics text book, teachers guide and syllabus and other related documents from the school. Furthermore observation regarding the availability of school facilities, the practical application of active learning in class rooms and related materials were made.

From the above it can be understood that both students and mathematics teachers are selected to serve as the subject of the study. For this research all mathematics teachers of grade eleven and twelve, and representative students from both grades (grade eleven and twelve) are selected as the subject of the study.

3.3.2. Sample size:

In order to generalize findings we look for samples to be representative (O'leary, 2004, p.103). Hence the sample of the study covered four preparatory secondary schools out of the six preparatory secondary schools of Southern Zone of Tigray Region. These are Biruh Tesifa Preparatory Secondary School, Hidase Preparatory Secondary School, Maichew Preparatory Secondary School, and Timuga Preparatory and Secondary School. This comprised 66.7 percent of the total preparatory secondary school in the Zone.

Even though there is no single rule that can be used to determine sample size (Singh, 2006, p.93) the researcher used sample size table using 95 percent confident levels for random samples which is given in Cohen, Manion and Morrison (2007, p. 104) in determining the

sample size of the respondent students. Hence, 431(30%) students were selected from the total population of 1438 students. Out of this figure 149(34.3%) of them were female students. Since there are only 12 mathematics teachers of preparatory secondary school in the study area, all of them were included in the study. Out of 12 mathematics teachers in the study area, 4 of them were head department of mathematics teachers and the researcher selected them purposely for interview and the rest were used to fill teacher's questionnaire.

3.3.3. Sampling technique

The researcher used simple random sampling in order to select representative schools. In simple random sampling each member of the population under the study has an equal chance of being selected and the probability of a member of the population being selected is unaffected by the selection of other members of the population (Cohen, et al., 2007, p.110). In addition to this a stratified random sampling technique followed by systematic random sampling was used for selecting representative students for the study. The researcher used first stratified random sampling in order to classify the students by their grade level and their sex. This is because according to Alston and Bowles (2003, p.85) stratified random sampling allows us to divide our sampling frame into various strata or groups before selecting our sample. And this helps to ensure that each group is represented proportionately or disproportionately to their numbers in the overall population.

Then, the numbers of representative students in each class were taken proportionally according to the total number of students in each class. Proportionate sampling refers to the selection from each sampling unit of a sample that is proportionate to the size of the unit (Singh, 2006, p.104). Then after, the researcher used systematic random sampling technique to select the representative sample of students from each class and sex. Systematic random sampling involves selecting of subjects from population list in a systematic rather than random fashion. The size of the interval between chosen units is decided by dividing the total population or sampling frame, by the desired sample size (Alston and Bowles, 2003, p.84). Mathematically it can be written as $k = \frac{\text{total sampling frame}}{\text{desired sampling}}$, where K is the size of the interval between chosen units. The first subject is randomly chosen from 1 to K (ibid). Then every K^{th} individual will be chosen from the list until the sample size will be computed (Fraenkel and Wallen, 1932, p.99).

3.4. Procedures and instruments of data collection

3.4.1. Data collection procedures

The researcher has used the following steps to collect meaningful data for the study. First, relevant literature was reviewed to get adequate information on the topic. Second, objectives and research questions were formulated to show the direction of the study. Finally, data gathering tools were developed and piloted.

3.4.2. Instruments of data collection

Throughout this study questionnaire, classroom observation, and interview as well as document analysis were used to collect complete data for the study.

3.4.2.1 Questionnaire: According to Barr, Davis and Johnson cited in Singh (2006, p.192) “A questionnaire is a systematic compilation of questions that are submitted to a sampling of population from which information is desired.” It is the most common technique to gather data from descriptive survey study (Leedy, 1993 cited in Gebeyaw Teshager, 2007, p.45). Good and Hatt cited in Aggarwal (1994, p.388), also explained that ‘the word questionnaire refers to advice for securing answer to questions by using a form which the respondent fills in himself’. Thus, the researcher developed both closed and open-ended questionnaire in order to gather data from his respondents.

Hence to assess the understanding and experience of teacher respondents on active learning both closed-ended and open-ended questionnaire were used. And also 11 items were prepared for student respondents to observe students difficulty from actively participating in mathematics class room as well as to see teacher’s activity. In addition to this 13 likert-scale items were prepared to investigate the major factors that hinder the practice of active learning in teaching-mathematics and to see the attitude of teachers towards active learning. The scale ranges from SA (5) to SD (1) for positive items and the reverse for the negative items. Furthermore, to see on how much the teachers use different instructional teaching methods in teaching mathematics 11 Likert- scale items were prepared.

3.4.2.2. Class room observation check lists

Observation is the study of individuals in natural situation and hence it helps to record the actual behavior of an individual as it exists. For this purpose observation check list was

developed. This observation check list has two parts. The first part was designed to analyze the extent to which the mathematics teachers use various teaching methods, teaching materials and related techniques in providing opportunities to their students in mastering the objectives intended by the syllabus during the instructional process. The second observation check list was designed to check the availability of teaching materials' in the school which are important (helpful) for teaching learning mathematics. Furthermore, the observations were mainly focused on the practical application of active learning in teaching-learning mathematics class rooms.

3.4.2.3 Document analysis: This document analysis includes mathematics syllabi, text books and teacher's guide of both grades (grade eleven and twelve) as well as other concerned materials for the study. The main objective of this document analysis was to observe whether the given exercise and activities in each unit of the text books are appropriate to use active learning or not, and to observe if there is a presence of direct discussion based on different active leaning approaches in the content presentation of each unit. In addition to this the analysis was made on the volume of the contents of each text book.

3.4.2.4. Interview: for enhancement of the information gathered by other instruments and for clearing some of unpredicted data, interview items were prepared to make face to face communication with the department heads of mathematics teachers. Because as Koul (1996) cited in Gebeyaw Teshager(2007,p.45) explains interviewing is necessary to get deep feeling, perceptions and values or how people interpret the world around them and past events that are impossible to replicate. Based on this, the researcher prepared 7 open-ended interview items which are related to the practice of active learning in teaching learning mathematics. Thus a detailed interview was made with the department heads of mathematics teachers by using semi-structured interview. Because semi-structured interview questions are flexible and then new question can be brought up during the interview as the result of the interviewee says.

3.5. Pilot study

Following the design and preparation of each instrument particularly the questionnaire was pre-tested with small groups that have similar characteristics with actual respondents of the study. To this end the questionnaire was administered among 28 respondents (25 student respondents and 3 teacher respondents) in Hayelom Areaya Preparatory Secondary School. Out of this figure 23 (20 student respondents and 3 teacher respondents) of them were filled and returned the questionnaire.

The main purpose of this pilot study was to check the appropriateness of the items and to make necessary correction based on the obtained feedback from the respondents. Therefore the researcher used Cronbach's alpha (α) in order to see the reliability of the items. Hence, the reliability of students' questionnaire was calculated by SPSS and the result in the cronbach's alpha was 0.816(see appendix E). Therefore, its cronbach's alpha value is recommendable. Similarly the developed teachers' questionnaire was first adiminstered to three teachers selected for the pilot study. After it has been filled in by the teachers each questionnaire was examined item by item and it doesn't show any significant defects. Furthermore the validity of the instruments was validated by the advisors and co-advisors. Hence, after some improvements the questionnaire was administered in to the original study.

3.6. Method of data analysis

Analysis of data means to draw some results from the raw data after the proper treatment (Singh, 2006, p.222). It includes comparison of the outcomes of the various treatments upon the several groups and making of a decision as to the achievement of the goals of research (ibid). Hence, to analyze the collected data both qualitative and quantitative data analysis techniques were used. For the quantitative data collected through questionnaire/ closed-ended questionnaire/ percentage, mean and standard deviation were selected. Paired sample t-test was also used in this study to compare means of the instructional teaching methods. Percentage was also used to explain personal characteristics of the respondents. Whereas the data collected through observation, interview, open-ended questionnaire and document analysis were analyzed qualitatively by descriptive statements. Finally, after the data were carefully computed, organized and tabulated according to the similarities of issues raised in the questionnaire by employing appropriate statistical methods, findings were summarized, concluded and recommendation were made.

CHAPTER FOUR

PRESENTATION AND INTERPRETATION OF THE DATA

This chapter deals with the presentation and interpretation of the data gathered from the concerned respondents. Accordingly, the presentation and analysis was made based on the data gathered from four preparatory secondary school representative students of Southern Zone of Tigray Regional State and all mathematics teachers of those selected schools. Moreover in gathering the data the researcher used questionnaire (both closed and open-ended), interview, document analysis and observation. Generally, this chapter includes two main parts: characteristics of the respondents, and analysis and interpretation of the collected data.

4.1 .Characteristics of respondents

The major categories of respondents in this study were mathematics teachers and students of Southern Zone of Tigray Preparatory Secondary School. Those respondents were asked to indicate their personal background information through questionnaire and interviews. Description of the characteristics of the respondents gives same basic information about the sample population involved in the study. Then the following tables (table- 1 and 2) contain the general characteristics of the respondents involved in the study.

According to the personal detail shown in table-1 below all of the respondent teachers (100%) were male.

Table -1: Characteristics of Teacher Respondents

No	Items	Response	
		In number	In %
1.	sex		
	M	12	100
	F	-	-
2.	Qualification		
	1. Diploma	-	-
	2. Degree	12	100
	3. Master	-	-
	4. Any other	-	-
3.	Teaching experience		
	1. ≤ 2	-	-
	2. 3-6	5	41.7
	3. 7-10	3	25
	4. 11-15	4	33.3
	5. ≥ 16		-

Also the table shows that all of the respondent teachers have teaching experience greater than 3 years. This indicates that those teachers have got good opportunity to develop good experience and understanding of the subject matter they teach as well as to select which instructional teaching method is appropriate to teach the subject including where and when it is appropriate. Regarding the qualification of the respondent teachers all of them have first degree and this is good because according to the Educational and Training Policy and Its Implementation of Ethiopia (2008, p.49) all secondary school students should taught by degree holders.

Table -2: Characteristics of student Respondents including their school

		sex	Bruh Tesfa		Hidase		Maichew		Timuga		Sum of total population	Total Sample size
			Total population	Sample size	Total population	Sample size	Total population	Sample size	Total population	Sample size		
Grade	11	male	133	40	193	60	125	38	51	15	502	153
		female	57	17	84	23	99	29	27	8	267	77
	12	male	115	35	157	47	113	34	44	13	429	129
		female	67	20	79	24	80	24	14	4	240	72
		Total									1438	431

Table -2 shows that 282(65.4%) of the respondent students were male where as 149(34.6%) of them were female students. This shows that the participation of female students in preparatory secondary schools of the study area is less than that of males. Regarding their educational level 230(53.4%) of the respondents were grade eleven where as the rest of them were grade twelve students. This figure indicates that student of grade eleven were large in number.

4.2 Analysis and interpretation of the data

The respondents of the study area were asked different questions which are related to the teaching-learning process of mathematics through active learning approach in Preparatory Secondary schools. Accordingly, a total of 439 questionnaires were distributed for the respondent students and mathematics teachers of preparatory secondary schools of the study

area. From the total of 439 questionnaires 381 questionnaires (373 students questionnaire and 8 teacher's questionnaire) were properly filled and returned. Hence the analysis of the questionnaire was made based on 373 students' and 8 teachers' response.

In addition to this an interview questions were prepared for the department head of mathematics teachers from each preparatory secondary schools and all of them have responded to the questions. In addition to this an observation were made regarding class-size, teaching-learning process, availability of instructional materials (IM) and other related materials on the selected sample schools. Besides to this document analysis was also made. Hence, the interpretation and analysis of the data was made based on the response obtained from the respondents, from observation as well as document sources. Moreover, the frequency distributions, percentage, mean and standard deviations were computed for the purpose of analyzing and interpreting of the findings. The interviewee teachers were coded from teacher (T₁) to teacher (T₄).

4.2.1. Analysis and interpretation of teachers' response

4.2.1.1. Assessment of teachers understanding and experience on active learning

As it is indicated in table-3 below in the first item, all of the respondents were interested to teach mathematics through active learning. Likewise the data obtained from the interview indicated that almost all of the respondents had good understanding about active learning approach except some problems on how to apply it in the class room. For example, one interviewer teacher (T₁) defined active learning as follows:

“Active learning teaching methods is one of the instructional teaching methods in which it leads students to write, read and do different activities within the class room but the main problem is it is not appropriate for all students. This is because, according to him, most of the students have lack of good back ground knowledge of mathematics as well as active learning”.

Most of the interviewee teachers had such kind of views regarding active learning. From this result one can understand that the respondents have good understanding about active learning but the nature of the learners determine the way of practicing active learning effectively within the class room. In other words to practice/implement active learning effectively within the class room it needs great effort from both teachers and students.

Table-3: Teachers' interest and training on active learning

Items	Alternative s	No of respondents teachers	%
1. Are you interested to teach mathematics by active learning approach?	Yes	8	100
	No	-	-
2. Did you take a continuous training on how to use/practice active learning in teaching mathematics?	Yes	3	37.5
	No	5	62.5
3. If your response to question 2 is "Yes" how frequent do you apply the objective of the training in your daily lesson in teaching mathematics	Always	-	
	Sometimes	3	100
	Rarely	-	-
	Not at all	-	-
4. If your response to question 2 is 'No' do you believe that you need some training/ orientation on how to practice active learning in teaching mathematics?	Yes	5	100
	No	-	-

Similarly as it is indicated in the same table of item-2, 3 (37.5%) of the respondents response indicated that they took a training concerning on how to practice active learning approach in teaching mathematics. Whereas the remaining respondents' response indicated that they didn't take a continuous training concerning how to practice (use) active leaning approach in teaching mathematics. In addition to this, T₄ said that:

"There was no a continuous training which is given to mathematics teachers concerning how to use (practice) active learning in the class room directly from the school administration".

The result of item-3 in table-3 indicate even though 37.5% of the respondents took an orientation on how to use(practice) active learning approach in teaching mathematics but they used the objective of the training as sometimes. On the other hand, 5(62.5%) of the respondents had interest to take a training concerning on how to use active learning approach in teaching mathematics.

As the result of table-3 indicated , even though most of the respondents had not take a continuous training on how to use active learning approach in mathematics class, all of them had interest to teach mathematics through active learning as well as to take a training concerning on how to use active learning approach in teaching mathematics.

Table-4: Teachers' activities during the implementation (practice) of active learning

Items	Alternatives	No of respondents	%
1. How do you monitor the progress of your students work while you are implementing active learning approach?	A. By asking students to provide regular reports about their progress	-	
	B. By visiting each group while they are working to check on progress and help where necessary	6	75
	C. By asking students to provide final products of their group work	2	25
2. To what extent active learning approach in mathematics class involve students in the teaching learning process?	A. high	3	37.5
	B. moderate	4	50
	C. low	1	12.5
3. How often do you assign your students to work in groups?	A. Always	1	12.5
	B. Sometimes	7	87.5
	C. Rarely		
	D. Not at all		
4. How often do you encourage your students to involve in active learning approach?	A. Always	2	25
	B. Sometimes	5	62.5
	C. Rarely	1	12.5
	D. Not at all		

As indicated in table-4 of item-1 the majority of the respondents (75%) response indicated that they monitor their students work while they were practicing active learning approach in the class room by visiting each group to check students work and to help them when necessary. Whereas the remaining two respondents monitor students work during the practice of active learning in the class by asking students to provide final products of their group work.

In the same table to what extent active learning approach in mathematics class involve students in the teaching learning process is rated as a “moderate” by 4(50%) of the respondents. The remaining percentages, 37.5% and 12.5% of the respondents indicated that active learning involves the students in the teaching-learning process as “high” and “low” respectively. The majority of the respondents (87.5%) result indicated that active learning involves students in the teaching-learning process. On the other hand T₃ explained that:

“Active learning in general involves the students in the teaching-learning process directly but when we come to see our students they are not voluntary to involve themselves directly in the teaching-learning process. He further explained his idea by saying the major reason for this is students back ground; they were developed through the traditional teacher-centered method of teaching (spoon-feed system of teaching).”

T₃'s idea have shared by all of the interviewee teachers. From this one can understand that even though active learning approach is easily applicable for students to involve in their learning directly but their back ground affects the practice of active learning approach in the study area.

Similarly in table-4, 7(87.5%) of the respondents said that, they sometimes assigned their students to work in groups. On the other hand the remaining one respondent rated item-3 as always. This result indicated that the majority of the respondents assigned their students to work in groups. When assigning learners for group work, membership, it is advisable if it is based on the experts level and learning style of individual group members so that individual team members can benefit from one and anthers strength(Mathematics Teachers Guide for Grade Eleven and Twelve ,2009, p.1). But during the class room observation most of the time teachers tried to assign their students in order to make groups by saying orally, make a group. When came to the reality this way of saying indicated that teacher do not have careful planning for group work. According to Westwood (2008, p.68) careful planning is required if group work is used to achieve the desired educational and social outcomes. In line with this Nilson (2010, p.155) argued that one particularly powerful student-active method, when implemented properly, is to put students in pairs or small groups to work and learn together. She also argued that when people work together with a cooperative ethos/culture, they can accomplish much more than they can as individuals working apart, that is, two heads are better than one, three heads are better than two, and for some tasks, four or five heads are best. Generally giving serious group work for students helps them to become active learner and to share experience from their friends and colleagues.

Furthermore teachers were also asked to rate how often they encourage their students to involve in active learning approach, in item-4 of table-4. Thus, 2(25%) and 5(62.5%) respondents rated it as “always” and “sometimes” respectively. But one respondent teacher rated item-4 as “rarely”. Hence the response of the majority of the respondents indicated that they encourage their learner to involve in active learning approach sometimes. This indicates

that teachers had some problems in motivating/encouraging their students to engage in active learning approach in the study area. According to Feldman (1998b) cited in Nilson (2010, p.4) people learn actively when they are motivated to do so by the encouragement and enthusiasm of other people in their lives.

4.2.1.2 Instructional teaching methods/strategies

In order to investigate the extent to which active learning is practiced in the study area the respondent teachers were asked to provide information how they had been employing different instructional methods of teaching. Accordingly, table -5 shows that the percentage of the respondents who rated each of the 4-alternatevies response scales for each item. Similarly the table indicates the mean of the response given for each of the instructional teaching methods/strategies and also it shows the variance (*Sd*) among the response of the subjects.

The higher the mean (greater than or equal to 2.5) shows that the particular teaching method is used always and on the other hand the lower the mean score (less than 2.5) shows that the tendency of using that particular teaching method to deliver the subject matter is low.

In table-5 below there are 11 different instructional teaching strategies. Those teaching methods represent either teacher-centered (the traditional teaching method) or the modern teaching methods (active learning approach). Accordingly, the first three instructional teaching methods represent the traditional teacher-centered method of teaching whereas the remaining represents active learning approach. Hence the response of the respondents towards those methods of teaching would be discussed as follows.

Table -5a: instructional teaching methods/strategies

No	Items	Alternatives								Mean	Sd
		Always(4)		Sometime s(3)		Rarely(2)		Never(1)			
		No	%	No	%	No	%	No	%		
1.	Oral questioning and answering	4	50	3	37.5	1	12.5			3.38	.74
2.	Lecture/explanation	6	75	2	25					3.75	.46
3.	Demonstration	2	25	4	50	1	12.5	1	12.5	2.88	.99
4.	Brain- storming			1	12.5	5	62.5	2	25	1.88	.64
5.	Role play			1	12.5	3	37.5	4	50	1.63	.74
6.	Group work	2	25	3	57.5	3	37.5			2.75	.46
7.	Group discussion			6	75	2	25			2.88	.83
8.	Inquiry learning	1	12.5	1	12.5			6	75	1.63	1.19
9.	Discovery learning			1	12.5	1	12.5	6	75	1.38	.74
10.	Problem solving	1	12.5	3	37.5	3	37.5	1	12.5	2.5	.93
11.	Project work					4	50	4	50	1.5	.54

As the mean score of the items in table- 5 indicated that most of the respondents always used the lecture/explanation method of teaching($\bar{x}$ = 3.75) followed by Oral questioning and answering method of teaching ($\bar{x}$ =3.38). Similarly the demonstration method of teaching ($\bar{x}$ = 2.88) is rated as sometimes. When came to the other instructional teaching method/strategies, active learning approach, which are listed in table-5a the mean scores of group discussion($\bar{x}$ = 2.88), group work($\bar{x}$ = 2.75) and problem solving ($\bar{x}$ = 2.50) indicated that the respondents used them as sometimes. Whereas the mean scores of Brain- storming ($\bar{x}$ = 1.88) indicates that the respondent teachers rated it as rarely. That means they employ it rarely. On the other hand the mean scores of Role play($\bar{x}$ = 1.63), Inquiry learning($\bar{x}$ = 1.63), Project work($\bar{x}$ = 1.50) and Discovery learning($\bar{x}$ = 1.38) shows that the respondent teachers never used in the teaching learning process.

However, this is not adequate to understand whether there is significant difference between active learning and teacher-centered methods of teaching; hence table-5b shows the summary

of paired sample t-test. The researcher used this test because the two groups (active learning and teacher-centered) are related and he wants to compare mean differences:

Table-5b Paired sample t-test, comparison of active learning and teacher-centered instructional teaching methods.

		Paired sample statistics		paired sample t-test				
Pair	N	Mean	<i>Sd</i>	<i>Mean difference</i>	<i>Sd</i>	<i>df</i>	<i>t</i>	Sig. (<i>p</i>)
Active learning	8	2.14	.309	-0.86	.567	7	-4.3	.004
Teacher centered	8	3.00	.436					

As shown in table -5b, the *p* - value is .004. Since this value is less than 0.05 critical values, so it is statistically significant. In other words, the mean scores of the instructional teaching methods are not homogenous. This indicated that there is a statistically significant difference between the mean scores of the instructional teaching methods. This implies that, all the means are significantly different from each other. Therefore, this result indicated that most of the respondent teachers employed the teacher centered method of teaching.

Generally, as shown in table 5- a & b, most of the respondents employ the teacher-centered method of teaching in their teaching-learning process. This fact was also supported by the class room observation. During the time of classroom observation, even though a few teachers were observed trying to make their lecture active by asking students and encouraging them to ask question for clarification and at the same time using few active learning approaches like group discussion and group work during their lecture, most of the time teachers used traditional method of teaching.

Even though our current educational policy gave emphasis on preparing citizens who have a problem solving ability which will be achieved when students actively involved in investigate and thinking rather than memorizing of facts and procedures. But the data obtained from the observation and teachers' questionnaire indicated that the method of teaching in which most respondent teachers employed is teacher-centered. This method of teaching did not give chance for students to involve actively in the teaching-learning process by themselves with some support from their teacher if necessary. Such traditional method of teaching approach

will not enable students to value mathematics, develop mathematical reasoning, be confident in their mathematical abilities and not enable them to become mathematical problem solving (Mc Combs, 1993 cited in Assefa Shimelis, 2005, p.78).

Table- 6: teachers’ attitude towards active learning

N o	Items	SA		AG		UD		DA		SD		Mean	Sd
		N o	%	N o	%	N o	%	N o	%	N o	%		
1	Teachers lack of interest towards the profession (teaching) has affected the practice of active leaning in mathematics	1	12.5	5	62.5					2	25	3.00	1.41
2	Active learning creates good opportunities to share experience and encourage friendship among students	7	87.5	1	12.5							5.00	.000
3	The current teachers’ training policy/institutions has affected the practice of active learning in mathematics class	2	25	4	50					2	25	3.50	1.06
4	Active learning approach is effective in teaching – learning of mathematics in preparatory secondary schools	3	37.5	1	12.5	3	37.5	1	12.5			4.13	.991
5	Active learning dose not enhance self-confidence and independent learning of students			1	12.5	2	25	3	37.5	2	25	4.13	.835
6	Active learning enhance active involvement of students in learning instead of passive listening	2	25	4	50	2	25					4.25	.707
7	Lack of students understanding and attitude towards active learning has affected its practice	4	50	3	37.5	1	12.5					4.25	.707

Teachers’ attitude is one of the major factors that influence their decision in adopting any type of instructional approaches in general and in determining the effectiveness and proper use of

active learning approach in particular. In supporting this idea Yalew (2004) cited in Yosef Meseret (2008, p.23) noted that the philosophy of teachers adhered to, the values and conceptions they have about good teaching, determine the type of teaching approach they employ and the way they teach their students. Moreover, Herald (2003, p.6) argued that Great Attitude→Great Result; Good Attitude→Good Result; Average Attitude→Average Result and Poor/Bad Attitude→Poor/Bad Result. Accordingly, the first item in table-6 was asked to know how far teachers' interest towards their profession affected the implementation/practice of active learning. Hence, 5(62.5%) of the respondents have agreed that their lack of interest towards their profession affected negatively the practice of active learning. Similarly one respondent teacher said that his lack of interest towards his profession strongly affected the practice of active learning. On the other hand only two respondents have argued that their lack of interest towards their profession did not affect the practice of active learning. Thus most of the respondents response indicated that their lack of interest to their profession affect the practice of active learning approach.

Furthermore as indicated in table-6 of item-2, almost all of the respondents argued that active learning creates good opportunities to share experience and encourage friendship among learner. This is because, 7(87.5%) and 1(12.5%) respondents rated item-2 as “strongly agree” and “agree” respectively. Similarly the fourth item in table-6 deals with the appropriateness/effectiveness of active learning approach in preparatory secondary schools in teaching-learning mathematics. Hence, 3(37.5%) and 1(12.5%) of respondents said that the effectiveness of active learning in preparatory secondary schools rated as “strongly agree” and “agree” respectively. But only one respondent teacher considered as active learning is not appropriate /effective to teach mathematics in preparatory secondary schools. There were also three teachers who didn't give their idea on the effectiveness of active learning in preparatory secondary schools.

The information obtained from the majority of the respondents to item-2 and item-4 shows that active learning is appropriate to teach mathematics in preparatory secondary schools and it creates opportunities to share experience and encourage friendship among learners. Active learning is particularly effective for younger learners (ICDR, 1999 cited in Amenu Olijirra, 2005, p.25). Further the hand book elaborates why active learning is effective for younger

learners. That is the young learners learn best when they can connect what is being learned with their own life, this makes meaningful.

In item-3 table-6, the respondents were asked whether the current teacher training policy/institutions has affected the practice of active learning or not. Accordingly 4(50%) and 2(25%) of the respondents rated, it as “agree” and “strongly agree” respectively. Only two respondents rated it as “strongly disagree”. The response of the majority of the respondents for this item indicated that the current teachers training policy/ institutions have affected the practice of active learning. In addition to this according to:

“ T₂ our universities and colleges of teaching styles were dominated mainly by the traditional method of teaching, lecture and we all teachers have learned in these universities and colleges by this method of teaching and hence we tried to teach as we have learnt.”

As it was discussed in the literature part the way teachers trained can strongly affect the whole educational process particularly in practice of active learning, because teachers teach as they have learnt but not as they are told to do.

Within the same table, 3(37.5%) and 2(25%) respondents rated item-5 as “disagree” and “strongly disagree” respectively. On the other hand one respondent teacher rate item-5 as agree. But two respondent teachers rated it as undecided. From this result one can understand that active learning can develops self-confident and independent learning among the learners.

In the sixth item in table-6 teachers were asked to rate whether active learning involves students in the learning process or not. Accordingly, 2(25%) and 4(50%) respondents rated it as “strongly agree” and “agree” respectively. But two respondents rated it as “undecided”, they had neutral idea. Hence, according the majority of the respondents’ response, active learning may enhance active involvement of the learners in the learning process. In addition to this Stampen(2000)cited in Yosef Meseret(2008, p.17) defined active learning as a form of learning that directly engage the students in their learning process, it can be contradict with the passive learning where the student is passively taking information for example from lecture. But when came to see the reality of teachers and students activities during the class room observation in the study area; it can be observed that, except few teachers who gave some exercise and group discussion, almost all of the time was used by the teacher in

explaining the definitions and theorems, in doing examples as well as in giving solution to the given exercise. In other words the participation of students was very low during the teaching learning process. That is, students activity were observed in copying and listening for their teacher activities instead of they ask and answer questions, doing class room activities, making group discussions actively and doing other activities which were given by their teacher. In addition to this, even though they were given some exercise by their teacher after he made some explanations and doing some examples most of the students were simply copy the exercise and wait for their teacher until he gave the final solutions of the exercise. In other words no more than 4 or 5 students in a class were observed in answering the given exercises.

The last item in table-6 deals with students' understanding and attitude towards active learning. In relation to this half of the respondents rated item-7 as "strongly agree". While the remaining three respondents rated it as "agree". But only one respondent teacher did not gave his suggestion whether lack of students understanding and attitude towards active learning affects the practice of active learning or not. Hence, most of the respondents (87.5%) argued that lack of students understanding and their attitude towards active learning affected the practice of active learning in the class room. Feder and Brent (1996) cited in Yosyef Meseret (2008, p.27) noted that some students view learner-centered (active learning) as a threat or some kind of game done to them. These students whose teachers have been telling them everything they need to know from the first grade, as they said.

4.2.1.3. Major factors that affects the practice of active learning in teaching-learning mathematics and their suggested solutions

As it can be understood from the previous discussion, the respondent teachers didn't practice active learning approach effectively as intended by the policy documents. Hence, to investigate what factors affect the practice of active learning approach in teaching-learning mathematics; the researcher collected data from the respondents of the study through questionnaire, interview and class room observation. Then the collected data was presented as follows.

As indicated in table-7 below, 3(37.5%) and 4(50%) of the respondents rated item-1 as "strongly agree" and "agree" respectively. Only one respondent teacher rated item-1 as "undecided", has a neutral idea. The majority of the respondents argued that the tendency of

teachers towards the traditional teaching method is the major factor that affects the practice of active learning. From this result it can be said that tendency of teachers towards the traditional teaching method is one of the factors that affect the practice of active learning in teaching-learning mathematics. This idea is supported by Amenu oijira (2005, p.91), which states that teachers' tendency to traditional teaching method is one of the major factors that influence negatively the effective implementation/practice of active learning.

Table- 7: Possible factors that may influence the practice of active learning

N o	Items	SA		AG		UD		DA		SD		Mean
		N o	%	N o	%	N o	%	N o	%	N o	%	
1.	Teachers tendency to the traditional method of teaching has affected the perception of students toward the practice of active learning in mathematics	3	37.5	4	50	1	12.5					4.25
2.	Large number of students in the class room has affected the practice of active learning in teaching mathematics in your school	4	50	4	50							4.5
3.	Shortage of important materials and teaching aids has no effect for the practice of active learning in mathematics class in your school			2	25	1	12.5	4	50	1	12.5	4
4.	Shortage of time to apply active leaning in mathematics class has affected its implementation in your school	5	62.5	3	37.5							4.63
5.	Students sitting arrangement has no effect for the practice of active learning in learning mathematics in your school					1	12.5	3	37.5	4	50	4.13
6.	lack of encouragement and understanding of the administration towards active learning has no effect on the practice of active learning			2	25	1	12.5	2	25	3	37.5	4

Furthermore, Hailom and Plass (1998 cited in, *ibid.*) supported this idea. Similarly the respondents were asked to give their opinion for item-2 in table-7. Hence, the majority of the respondents 4 (50%) and 4(50%) rate it as “strongly agree” and “agree” respectively. This shows that all the respondents argued that large class size is one of the major factors that

affect the practice of active learning. This fact is also supported by the data obtained from other instruments like interview. Accordingly, teacher (T₁) said that:

“ In this year the maximum number of students in one class are 55 and this seems small in number relative to the previous years but it is difficult to practice /employ active learning approach effectively in teaching mathematics by one teacher unless and otherwise the number of students should decrease from this figure to 40 and below it.”

In line with this Dugles (1954) cited in Youhannes Benti (2005, p.38) suggested that since there must be sufficient space between students with in the class, the typical class room should not accommodate more than 35 to 36 students. In addition to this Rossa (1998) cited in Assefa Shimelis (2005, p.61) explained that teachers effectiveness is small in high schools with large class size and reduced can improve students' learning, affective developments and achievements. In other words teachers with small class size will have high affectivity and have high confidence in their ability in completing their task effectively (ibid). If this is so teachers may develop the habit of using active learning approach in the teaching learning process in general and in mathematics in particular. Hence, the number of students in the class room affects teachers from using active leaning in their teaching process.

The majority of the respondents (50%) rated item-3 in table-7 as “disagree”. The remaining 2(25%) and 1(12.5%) respondents rated it as “agree” and “strongly disagree” respectively. But one respondent teacher rated it as an undecided, he had neutral idea. The result of the majority of the respondents for item-3 indicated that shortage of these materials has an effect for the practice of active learning in mathematics class.

Whether the teacher use teacher-centered or student-centered, active learning approaches, efficient use of time has a significant impact/role on student learning. Accordingly, item-4 in table-7 is rated by the majority of the respondents (62.5%) as “strongly agree”. While the remaining respondents rated it as “agree”. In general, the response of all respondents indicated that shortage of time has a greatest impact for the practice of active learning in the teaching-learning process of mathematics class. The data obtained from interview also supported this fact. Regarding to this T₃ explained his idea by saying:

“The large class size(that is greater than 40), the abstractness of the subject, shortage of time , work load(for example I am a teacher as well as head of the department) those and other related factors affect me from using active learning approach to teach mathematics effectively. ”

As a result of this, according to him, he forced to use the traditional method of teaching, lecture, in which teachers talk student listen and copy from the board what the teachers wrote on it and sometimes students ask which is not clear for them.

This result shows that shortage of time can be considered as one of the major factors that affects the practice of active leaning approach in teaching mathematics. As many findings indicated that time constraint is the major problem in implementation/practice of active learning approach. For example, Caple et al., (1995) cited in Amenu oijira (2005, p.94) explain even some teachers discourage active learning simply because it brings an extra demand in the planning, preparation and evaluation because they believed that active learning is pressurized by limited time and overcrowded subject matter. Further they said that even some teachers come to conclusion that pariticipatory, active based learning is best in theory but unrealistic in practice.

From the same table respondent teachers were also asked to give their opinion on students sitting arrangement in item-5. Accordingly, 4(50%) and 3(37.5%) respondents rated item-5 as “strongly disagree” and “disagree” respectively. Only one respondent teacher didn’t give his idea whether setting arrangement has an effect for the practice of active learning or not. From the response of the majority of the respondents one can understand that the setting arrangement is one of the factors that affect the practice of active learning. In supporting this idea Takele Wakjra(2008,p.40) argued that the physical environment and of schools such as class room arrangement, class size, furniture arrangement, class room appearance and layout as well as class room facilities contribute a lot to promote active learning approach.

In addition to this the data obtained from class room observation indicates that even though most of the preparatory secondary schools were newly constructed with blocks having good floor made up of bricks, good roof and having windows made up of glass in which light and air can easily enter the class, having easily movable chairs/desks and tables; there was a some problem in the size of the class rooms(they are small in size), as well as in the number

of the chairs/desks and tables, they were few in number. As a result of this the seating arrangement in each class was crowded. Hence, teachers have a problem in moving around the class to look and check their students work.

According to Yosef Meseret (2008, p.54) interpersonal communication skills, self-confidence, the disposition to handle the risk and inquiry skills (like skills in collecting, analyzing, and comparing information and communicating about it etc) are some of the skills learners need to have in order to learn successfully using active learning. Hence, there should be an encouragement for the learners' as well as for teachers, and understanding of active learning and how it can be practiced from the administration in order to practice it in the class room as desired by the policy documents. In contradict to this, the last item in table-7 indicates 3(37.5%) of the respondents rated it as "strongly disagree" with the idea of item-6. Similarly two respondents rate it as "disagree". But two respondents rated it as "agree". On the other hand one respondent teacher rated item-6 as "undecided".

In general the response of the majority of the respondents (62.5%) indicated that lack of encouragement and understanding of the administration towards active learning affected its practice. T₂ explained his idea regarding the school administration as follows.

"The administration of the school always see how much we teachers cover the contents of the text book not how much the students learn the contents of the text book." Further he extends his idea by saying "if we did not cover the contents of the text book within the given time interval the school administration considered us as lazy teachers and even we may not pass the outcome based evaluation. As a result of this we teachers forced to use the traditional lecture method of teaching so as to cover the contents of the text book within the given time interval." This idea was supported by all interviewee teachers.

Hence one can understand from this result teachers forced to use the traditional teaching method in ordered to cover the contents of the text books with in the given time interval. But such traditional teaching method will not enable all learners to become active learner, develop mathematical reasoning, be confident in their mathematical ability and become mathematical problem solvers rather it leads the learner to develop simple memorization. Moreover, it contradicts with our Educational and Training policy (1994) which gives high emphasis in

preparing citizens who have high problem solving ability and this ability will be achieved when learners are engaged actively in the teaching-learning process in general and in learning mathematics in particular.

In any case, real learning is not memorization. Most of what we memorize is lost in hours. In order to retain what has been taught, participants must chew on it. Learning can't be swallowed whole. A teacher can't do the mental work for participants because they must put together what they hear and see to form a meaningful whole. Without the opportunity to discuss, ask questions, do, and perhaps even teach someone else, real learning will not occur (Silberman, 2006, p.5).

In addition to those factors that were discussed above, some of the respondent teachers gave their reason on why they did not use effectively different active learning approaches in different parts of the teachers' questionnaire. According to them the major factors were the back ground of the learner, shortage of time, shortage of reference books, students lack of interest towards active learning and the subject matter, students have not the habit of participating in groups actively and volume of the text books (its contents are too vast).

From this one can understand that even though the qualification of the teachers, were all first degree and their teaching experience (all greater than or equal to three years), can be observed that as a positive factors that can enhance the teaching-learning mathematics effectively in the study area but the class size, volume of the text book (too vast), back ground of the students and shortage of time affected teachers negatively from using active learning approach.

4.2.1.4. Suggested solution from the respondent teachers

As it can be understood from the previous discussion there were some problems that affect the practice of active learning in the teaching-learning process. Most of the respondents suggested their own views on how to solve such kind of problems in teaching-learning mathematics in the study area. Accordingly, their suggestion would be presented as follows.

- Minimize the number of students in each class to 40 and below. This fact was also supported by different authors for instance, Rossa ,1998 cited in Assefa Shimelis 2005, p.61 ; Dugles ,1954 cited in Youhannes Benti ,2005, p.38. In addition to this the Ethiopian Minister of Education also point out that the numbers of

students in one class should be in between 40 to 45. But the data obtained from class room observation and document sources indicated that there are 50 and above students in one class. Therefore, the respondents' idea was acceptable.

- The students should have good back knowledge of mathematics and active learning from the early class.
- The government should give more attention for mathematics by giving continuous training on how to apply active learning in teaching mathematics.
- During the classification of students in to different sections it must be given consideration to students back ground knowledge in order to mix the lower learner, middle learner and higher learner proportional in each class.
- Since text book is very wide which is difficult to cover all topics using active learning the government should be either minimize the contents of the text book or should give enough time to apply active learning effectively in the class room.

From the above suggested solution on how to practice active learning approach in mathematics class room one can understand that if the number of students in the class room is manageable, have good back knowledge of mathematics as we as active learning from the early class, should be motivated to do in groups and help them when necessary etc, then active learning approach will be practiced effectively as intended by the policy documents otherwise not.

4.2.2. Analysis and interpretation of students response to the questionnaire

To investigate the practice of active learning approach in mathematics class, the researcher collected data from the participants of the study through questionnaire and class observation. The collected data from the respondent students was presented as follows.

The first item in table-8 was designed to investigate how often mathematics teacher of the study area encourage their students to do in groups. Accordingly, as it can be seen from the table, majority of the respondents 164(44 %) have replied that their teachers encourage them to do in groups sometimes. Whereas 105(28.1 %) of them responded that their mathematics teachers encourage them frequently to do in groups.

Table-8: students view of their teacher's class room activity

Items	Alternatives	No of respondents	%
1. How often does your mathematics teacher encourage you to do in groups?	A. Frequently	105	28.1
	B. Some times	164	44
	C. Rarely	73	19.6
	D. Never	31	8.3
2. Does your mathematics teacher arrange a make- up/tutorial class for you in order to develop your group discussion?	A. Yes, Frequently	87	23.3
	B. Yes, Some times	102	27.3
	C. Yes, Rarely	111	29.8
	D. No, Never	73	19.6
3. To what extent your mathematics teacher design group work activities to ensure that all your group members actively work together?	A. High	116	30.8
	B. Moderate	164	43.5
	C. Low	93	25
4. Does your mathematics teacher give you group discussion?	A. Yes, Always	102	27.3
	B. Yes, Sometimes	161	43.2
	C. Yes, Rarely	74	19.8
	D. No, Never	36	9.7
5. Does your mathematics teacher give you enough time for group discussion?	A. Yes, Always	94	25.2
	B. Yes, Sometimes	122	32.7
	C. Yes, Rarely	92	24.7
	D. No, Never	65	17.4
6. How often does your mathematics teacher advise you to read additional reference books from your library?	A. Always	99	26.5
	B. Sometimes	90	24.1
	C. Rarely	107	28.7
	D. Never	77	20.6
7. How often your mathematics teachers encourage you to ask unclear question?	A. Always	235	63.0
	B. Sometimes	81	21.7
	C. Rarely	31	8.3
	D. Never	26	7.0

On the other hand 73(19.6%) and 31(8.3 %) of the respondent students were reported that their teachers rarely and never encourage them to do in groups respectively.

From the result of item-1 in table-8, one can observe that most of the time students of the study area were not encouraged to do in groups. Students must be encouraged to do in groups, to communicate effectively about what they are learning and doing. In other words giving group work for students is one of the best mechanisms to become active learner. In supporting of this Mathematics Teachers Guide for Grade 11 and 12(2009, p.1) depicted that working with other learners gives learners real-life experience of working in group, and allows them to use their met cognitive skills. Learners will also able to use the strength of other learners and to learn from others (ibid). In addition to this Westwood (2008, p.68) argued that effective

teachers make use of group work as a component in their overall approach. Working in groups does not only increase students' active participation, but also it encourages social skill development, enhances communication and increases independence (ibid).

The second item in table-8 which was designed to know how often mathematics teachers arrange a make-up/tutorial class for their students in order to develop students group discussion ability. Accordingly, 111(29.8%) of the respondent students said that their mathematics teacher rarely arrange a make-up/tutorial class for them. On the other hand 102(27.3%) of them said that their mathematics teacher sometimes arrange a make-up class for them. Similarly 73(19.6 %) of the respondent students replied that their mathematics teacher never arrange a make-up/tutorial class for them. The majority of the students' response for item-2 showed that most of the time mathematics teachers of the study area did not arrange a make-up class for their students. But giving tutorial class for the students helps them to solve their individual problems as well as to develop their group discussion ability and at the same time it helps for the teacher to complete his course within the given period of time. In supporting this idea Sharma (2002, p.131) argued that it is the fundamental right of every person to get education in democracy. Therefore, instead of individual teaching, group teaching is emphasized so that the large group may be educated at the low rate of expenditure. But it is also true that in group-teaching, a general teacher cannot solve the 'personal' problems of every pupil. Its reason is that if he does this, he cannot finish his fixed syllabi in a time-bound manner. To remove this drawback of group-teaching, pupils are divided into small groups so that the personal problems which came across during group teaching may be solved successfully. Hence, a tutorial is a sub-part of the class in which a teacher tries to solve the problems of the small groups of the pupils through individual teaching (ibid). Hence the role of giving tutorial class is not only in helping students to develop their group discussion ability but also it helps teacher's in covering the contents of the syllabi within the bonded time interval.

As it can be seen in table-8 for item-3,164(43.5 %) of the respondents indicated that their mathematics teacher has an average (moderate) ability in designing group work activities. Whereas 116(31 %) of them were reported that their mathematics teacher have high ability in preparing group work activities and allow them to work in groups. On the other hand 93(25%) of them were replied that their mathematics teacher have low ability in preparing group work

activities. The result of item-3 shows that most of the respondent students have responded that, their mathematics teacher has an average ability in designing different group work activity.

As indicated in table-8 for item-4, 102(27.3 %) of the respondent students replied that their mathematics teacher always gave them group discussion. Whereas 161(43.2%) of them said that their mathematics teacher gave them group discussion sometimes. Similarly 74(19.8%) of them have said that their mathematics teacher rarely gave them group discussion. On the other hand 36(9.7%) of the respondent students replied that their mathematics teacher never gave them group discussion. Within the same table regarding the time given for group discussion (item-5), 94(25.2%) of the respondent students have replied that their mathematics teacher always gave them enough time for group discussion. Whereas 122(32.7%) of them reported that their mathematics teacher gave them enough time for group discussion sometimes. Similarly, 92(24.7%) of them said that their mathematics teacher rarely gave enough time for group discussion. On the other hand 65(17.4%) of the respondent students have reported that their mathematics teacher never gave enough time for group discussion.

In general the result of item 4 and 5 indicated that most of the students in the study area argues that they did not get enough time for group discussion and also their mathematics teacher does not always gave group discussion. As a result of this the learners may not be active as desired. This fact was also proved from the class room observation. That is the teaching-learning process in the class room was not mainly focused on the learners' activity instead the teachers activity was highly observed in doing activities and giving definitions.

As it can be seen from table-8 the sixth item, 90(24.1%) of the respondents asserted that their mathematics teacher sometimes advise them to read additional reference books. Whereas 107(28.7%) of the respondents replied that their teacher rarely advised them to read additional reference books. Similarly 99(26.5%) of them said that their mathematics teacher always advise them to read additional reference books and 77(20.6%) of them said that they never be advised to read additional reference books. This result shows that most of students in the study area have some problems in identifying appropriate reference books. As a result of this, students may be faced to some problems such as in doing some exercise which are given in their text book as well as by their teacher. Advising students to use additional reference books which are appropriate to them at that level is very important. This is because it saves students'

time and energy as well as it helps them to have an interest on the subject matter in general and their teacher in particular. As a result of this, students may have good relationship with their teachers and in general it makes the teaching-learning process attractive. Hence this kind of relationship leads the learner to become active learner in the class room instead of passive learner.

Similarly from the same table of item-7 in which the respondents asked to give their opinion whether their teacher encourage them to ask unclear questions for them or not, the majority of the respondents 235(63%) stated that most of their mathematics teacher encourage them always to ask question, while 81(21.7%) of them replied that they were encouraged sometimes. Similarly 31(8.3%) of the respondent students said that they were rarely encouraged by their teachers to ask a question. On the other hand 26(7%) respondents replied that they were not encouraged to ask a question. From this result it can be understood that most of mathematics teachers give freedom for their students to ask questions. And this way of teaching-learning process is effective in solving students' problem. In support of this idea Claxton (1990) cited in Scales (2008, p.148), suggested that good learning starts with questions, not answers. Asking good questions is the basis for becoming a successful learner. In line with this, according to (ibid) if children [and adults] do not ask questions, they were being spoon-fed. In addition to this Aggarwal (2001) argued that if questioning is used in the right way, at the proper time, it leads to new realms of understanding; it serve as means of organizing knowledge or correlating the result of educative experience and also it integrate personality.

Table-9: view of respondents regarding learning mathematics through active learning

Items	Alternatives	No of respondent students	%
How do you see/observe learning mathematics through active learning approach/student centered method of teaching?	A. Excellent	125	33.5
	B. Very good	73	19.6
	C. Good	151	40.5
	D. Bad	24	6.4

In table-9 the respondent students were asked to give their response on how they see (observe) learning mathematics through active learning approach. Accordingly, 151(40.5%) respondents argued that learning mathematics through active learning is good. Similarly 125(33.5%) of respondents stated that learning mathematics through active learning approach is an interesting (excellent). And also 73(19.6%) of them replied that learning mathematics through

active learning is very good. On the other hand only 24(6.4%) of the respondent students said that learning mathematics through active learning is bad.

Generally as it can be observed from the response of the students, the majority of the responses indicated that the students have some resistance towards learning mathematics through active learning. According to Weimer (2002) Students resist active learning/student centered approaches for a variety of reasons. Some of the most common reasons that students may resist in practicing of active learning approaches are since it requires more work, it is time consuming, it involve losses(i.e. whenever one move from one level of understanding to another there may be a lost something), and it may be beyond students capacity(ibid).

Table-10: view of respondents on learning mathematics

Items	Alternatives	No of respondent students	%
1. Students learn mathematics when every activity in mathematics is done by the teacher.	A. Agree	197	52.8
	B. Disagree	141	37.8
	C. Undecided	35	9.4
2. Students learn mathematics when they do any activities in mathematics regularly.	A. Agree	155	41.6
	B. Disagree	198	53.0
	C. Undecided	20	5.4

As it can be seen from table-10 of item-1 the majority of the respondents 197(52.8%) argued that students learn mathematics when every activity is done by the teacher in the class room. Whereas 141 (37.8%) of respondents did not agree with the idea of students learn mathematics effectively when every activity is done by the teacher. On the other hand 35(9.4%) respondents rated item-1 as undecided. Similarly from the same table of item-2, 155(41.6%) respondents argued that students learn mathematics effectively when they did each activity by themselves. Whereas 198 (53%) respondents did not agree with the idea of students learn mathematics effectively when every activity is done by the students themselves. But 20(5.4%) of the respondent students did not give their opinion, they have neutral idea.

As it can be observed from the result of table–10 most of the respondents argued that students learn mathematics when every activity is done by the teacher in the class room. And this indicated that students in the study area are not far from the traditional method of teaching, teacher-centered. But most of the time such traditional/teacher-centered method of teaching leads learners to become passive. And such passive learning will simply lead the learner to use simple rote memory and recalling of definitions as well as it contradicts with the

Educational and Training Policy of Ethiopia (1994) in which it give emphasis in the development of capacity and culture in the content of education, curriculum stricture and approach, focusing on acquisition of scientific knowledge to be used in solving problems.

Table-11 views of students on the factors that affect active participation in mathematics class

Items	Alternatives	No of respondents	%
What factors affect you from actively participating in mathematics class?	A. lack of encouragement from the teacher and school administration	88	23.6
	B. Since mathematics is a difficult subject	137	36.7
	C. Shortage of mathematics text book	36	9.7
	D. If you have any other factor please write here	112	30

Table-11 summarizes responses of students regarding the major factors that affect active participation in mathematics class. Accordingly, the majority of the respondents 137 (36.7%) indicates that, the difficulty of mathematics hinders their active participation in mathematics class room. While 88(23.6%) of them replied that because of low encouragement from the school administration and their teacher, their participation in mathematics class room was limited.

On the other hand there are some respondent students who gave their additional factors, in addition to the listed factors in table-11. The first reason which was replied by some of the respondent students was that, they have no habit of pre-reading and revision, lack of attending effectively in the class room, lack of confidence (frightened), lack of basic knowledge of mathematics from the lower grade, lack of awareness of doing mathematics exercise regularly, lack of the habit of doing in groups and have negative attitude towards mathematics in general and to active learning in particular. The second reason which was given by the respondents was shortage of reference books especially for the new text book and shortage of time (lack of wise use of time). The other reason which was given by the respondent students was lack of good school administration especially in shifting system (because students have both morning and afternoon with in the same day), and teachers' teaching style as well as teachers did not have the habit of checking students work whether students understood them well or not. Regarding the teachers' teaching style one respondent student reported that:

“Our mathematics teacher is qualified enough and I couldn’t blame him in terms of qualification but what I want announce for you is that he couldn’t get how we can be interested and clever in mathematics subject. That is the teacher’s style of teaching is the most complex and difficult. Because of this most students felt hopeless as they have not understood one topic and they completely become ambitionless and think after this as they couldn’t show progress in mathematics”.

The result obtained from student respondents regarding factors that affect active participation in mathematics class, have direct relation with what was discussed in teachers’ response regarding the major factors that affects the practice of active learning in teaching-learning mathematics above.

4.2.3. Availability of instructional materials to practice active learning

It is difficult to use active learning approach effectively in the classroom without appropriate instructional materials (IM). Moreover, students become active learner rather than passive recipients of knowledge if they are provided with the necessary learning materials/resources. Therefore, to perform/practice active learning effectively it needs different materials/resources like text books, syllabi, different reference books, charts and computers and if possible network connections. Hence, their availability and utilization of those materials under the study area are discussed as follows.

4.2.3.1. Availability and utilization of curriculum materials

In this study curriculum materials include, mathematics text books, teachers guide and syllabi. These materials are very important in teaching-learning mathematics in particularly through active learning approach. Because active learning needs full of materials in order to implement it effectively within the class room as well as outside of the class room. Then the researcher made document sources and an informal discussion with the directors of each preparatory secondary school in order to see the availability and utilization of these materials. Accordingly in all of the schools from February 2011 onwards both teachers and students have their own text books, teachers guide and syllabus. But according to all directors of the school, before February 2011 there was a soft copy for teachers only. As a result of this, most teachers and students were faced different problems in their teaching-learning process and hence the teacher forced to use the traditional method of teaching as well as students used the

old text book. The main reason for this problem was change of the old text books. But after February 2011, there was not any other problem concerning the availability of text books and teachers guide in the study area.

Even though after February 2011 there is enough mathematics text books and teachers guide in the study area the data obtained from class room observation indicated that almost all of the students and the teachers did not come with their text books and uses it in the class. Rather they simply came to the class with the piece of papers (teachers) and exercise books (students), but some students come to the class without exercise books. As a result of this teachers have a problem in giving class room exercise from the text book. This indicated that most of the teachers and students did not use the material effectively. Consequently, active learning in the class room was not practiced (implemented) as intended by the policy documents.

4.2.3.2. Availability and utilization of instructional materials in school pedagogical center (SPC)

As the researcher made an observation and an informal discussion with the leaders of SPC almost in all schools there was no IM which are related to mathematics in the SPC which are commercially produced by the school or any other organization. But there were few materials which are prepared from papers by school teachers, like van-diagram, cone, cylinder, prism and different graphs of trigonometric functions. But during class room observation no teacher was observed using different instructional materials other than chalk and board. Furthermore, according to one of the leader of SPC, most of the teachers have not interest to prepare mathematics teaching aid because most of mathematics teachers believed that to teach mathematics IM have not any impact on the subject matter so why we/ the teachers/ loss our energy and time in preparing IM.

Another factor that affects teachers from using and preparing IM is the presence of Plasma Television in which it covers almost the whole period in the previous years, according to T_1 . And also since almost all schools, except Timuga Preparatory and Secondary school, are newly opened or separated from the old secondary schools they are faced a problem in having their own IM, according to the leaders of SPC.

From the observation and document sources as well as data obtained from informal discussion from the leaders of SPC and some mathematics teachers through interview it can be concluded that there is SPC but have not well equipped material especially related to mathematics. And hence this may affects the teaching–learning mathematics through active learning. Because ,IM can help students understanding of materials being thought and even it can help in concept formation, to develop their experience such as doing, drawing ,reading, observing ,sketching, computing, discussing and speaking (Amare,1999 cited in Assefa Shimelis,2005,p.82). In addition to this Larcombe (1983) noted that IM supports mathematics learning at all stages in concept formation (ibid). Moreover, Silberman (2006) argued that people learn something well when they must hear it, see it, question it, discuss it with their peers, and do it. They might even teach it to someone else in order to solidify their understanding of the information or skill.

4.2.3.3. Availability and utilization of mathematics reference books in the school library

School library is one of the school facilities in which it is useful for education to be cared out effectively. In other words effective teaching program in schools depend on well-organized library. Academic library is the heart of school anatomy and the library in high school teaching reaffirms the fundamental role of the class room instruction (Rossoff, 1992 cited in Yohannes Benti, 2005, p.36). Accordingly in order to consider the availability of mathematics reference books in the school library the researcher made observation and informal discussion with the librarian of the schools.

As the researcher made an observation in the school library of the study area, there were different mathematics reference books but they were few in number. In line with this one librarian said that:

“There are some reference books in the library but not much with the number of students in the school. If for example greater than 50 students come to library at a time they did not get what they need as well as the size of the library is not enough for them.”

In addition to this according to some voluntary students even though there are few mathematics reference books which may help them, it is impossible to get them because they are reserved for those students who are a member of the librarian club who paid 12 birr per year for member ship. In other words, according to them, those who don’t pay and not a

member of the club couldn't borrow the books. Finally they generalized their idea by saying it is possible to say there is no library in the school because there is not up-to-date books that help the present curriculum in it.

This is not only the factor that affects students from reading reference books from the school library but also the seating is another factor. As the researcher observed except in one school, Bruh Tesfa Preparatory Secondary School, the seating arrangement of the chairs and tables are not suitable for them to sit on it.

From the observation and informal discussion from the librarian as well as some voluntary students it can be said that there is a library in the schools and there are books in it but they were very few in numbers and also they are not matched with the current curriculum. Hence this affects the teaching learning mathematics through active learning approach. In other words it may affect learners' performance what they have learned by reading books and their self-investigation/self-reading. In short learners forced to be dependent on the teacher and not to become active learner within the class room.

4.2.3.4. Availability and utilization of computer services in the school

Computer-based education has been well documented to improve learning at the elementary, secondary, higher, and adult-education levels (Woolf, 2009, p.17). More specifically, Sutherland (2007, p.67) argued that nowadays there is a wide range of excellent computer-based environments available for learning mathematics. Therefore, to see the availability of computer service in the school, the researcher made observation and informal discussion with Information Communication Technology (ICT) teachers. As the researcher observed the ICT class room in each school, there was an ICT class rooms. In short the following table summarizes students – computer ratio in the study area, Table-12.

Table-12: students – computer ratio in the study area

No	Name of school	Number of students	Number of computers	Ratio
1	Bruh Tesifa	372	19	20:1
2	Hidase	513	30	17:1
3	Maichew	417	40	11:1
4	Timuga	136	35	4:1

As it can be seen from table-12, the ratio of students to computers in Bruh Tesifa preparatory secondary school was 20:1, in Hidase preparatory secondary school was 17:1, in Maichew preparatory secondary school was 11:1 and in Timuga Preparatory and Secondary School was 4:1. The result of table-12 indicated that how serious the problem in these schools. In addition to this there was not internet service in all preparatory secondary schools of the study area.

From this it can be understood that most of the students did not get the access of computers in the study area. As a result of this the students' relationship with technology is very low. Westwood (2008,p.36) argued that computers in the classroom have provided learners and their teachers with fast and easy ways of accessing information, communicating electronically with others, and producing high quality written work and graphics. He conclude that computers and their associated software present great opportunities for educational purposes includes not only 'drill and practice' programs (used mainly in tutorial or remedial contexts for building students' skills in areas such as phonics, reading, arithmetic, or spelling) but also interactive instructional programs presenting factual information, simulations and role-play, problem-solving activities, video clips, and of course computer games, for motivating students, encouraging independent learning, and for improving the quality of educational programs. Therefore, the presence and use of technology in schools are one manifestation how school organizations become more diversified to meet the needs, interests and experiences of individuals or groups of the learner.

4.2.4. Text book analysis

According to Gönen and Kocakaya (2006, p.40) effective learning is the main aim of all educational activities and textbooks are very important for achieving this aim. Textbooks also have an important role in determining teaching and learning activities in the classroom (Kaya, 1997, *ibid*). Textbooks, which are well prepared, help teachers to use their time effectively in lessons and make positive contributions to students' achievement. However, if it is not prepared carefully, descriptions and figures in textbooks may result in misconceptions. In addition to this the Ethiopian Educational and Training Policy (1994) have asserted this idea and then not only have there been in content but also there have been in the manner of their publication.

Accordingly under this section the development and usage of mathematics teacher's guide, syllabus and the text book would be discussed. Because the development and usage of these materials consists of a larger proportion of the curriculum development and implement process. In other words these materials have a great role in facilitating the teaching-learning process through active learning in the class room as well as outside of the class room. In supporting this idea Behar (1994) cited in Solomon Belay (2004,p.89) argued that the syllabus and the text books have a power full force in class room instruction and reflect the dominant social, political and moral value that pervade/encompass at the time of their publication.

Therefore, as the researcher observed that all the units of the mathematics text books (both grade 11and 12); they were prepared in such a way that the teachers will start the classes by giving class room activities to make revision on topics related to the lessons and to warm up it, and then followed by giving/developing definition, group–work activities, exercises and finally summary as well as review exercise. Furthermore, all these activities can help the learner to participate actively within the class room. According to Mathematics Teacher's Guide for Grade 11 & 12 these activities should be carried out by the students to explore the word of mathematics to learn, discover and develop interest of the subject. Moreover, these activities covers from simple recalling up to higher order thinking skills like analyze, synthesis and evaluation. In addition to this, the respondent teachers were given their feeling on how the text book was prepared. Because they were asked; do you think that the new mathematics text book(s) was (were) prepared in such a way that it is easy organized to use active learning approach? Accordingly, most of the respondents (87.5%) said that the new mathematics text book is easily organized to use active learning approach. But one respondent teacher said that the new mathematics text book is not easily organized to use active learning approach. Generally the majority of the respondents said that the new mathematics text book(s) (both grade 11and 12) were designed in such a way that it is easy organized to use active learning approach. In supporting to this, Mathematics Teachers Guide for Grade 11 & 12 (2009, p.1) elaborates that the design of the course materials (student text book and teachers guide) for mathematics envisages active learning to be dominantly used.

When come to see to the contents of each text books. Both text books of grade 11 and 12 have a total of 11 units with 41 main contents and covers 474 pages, and 9 units with 38 main contents and covers 391 pages respectively. Regarding to this the respondent teachers and the

researcher from document analysis gave their own feeling and it would be presented as follows.

According to the data obtained from the respondent teachers as well as the researcher by himself even though the contents of the new text book was prepared in such a way that it is applicable to use active learning teaching approach (because it contains a plenty of class room activities and different exercise) in the teaching–learning process in the class room but its contents are too huge/its volume is too vast/ and it cannot be covered with in the given time interval (ten month) by using active learning approach. As a result of this,

T₄ said that we teachers forced to use the traditional teaching method in order to cover the contents of the text book with in the given time interval. In addition to this T₂ to tell how the volume of the text book is too vast and not matched with the time given (ten month), for example if you see grade 11 mathematics text book it has 11 chapters and 41 main contents within it and if I will use active learning approach effectively to teach grade 11 students regardless of the students interest and their back ground towards the method as well as of the subject, I will not cover it at the end of the year because to teach mathematics through this method of teaching requires plenty of time.

Therefore, the volume of the text books can be considered as one of the major factors that affects the practice of active learning approach in mathematics class.

General note on both grade text books:

- They need extra time and energy to complete their contents,
- There is a vertical as well as horizontal integration for example with chemistry, physics, business etc.
- They have similarity in their approach with the contents and exercise of the old text book
- The contents are too theoretical in the absence of necessary school facilities.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

This chapter deals with the summary, conclusion and recommendations of the study. Hence, this section starts by giving a brief summary of the general study and the major findings of the study followed by conclusions of the fundamental findings. Finally, some possible recommendations are given based on the major findings of the study.

5.1. Summary:

The main purpose of this study was to assess the status and practice of active learning approach in teaching-learning mathematics and to identify those factors that influence the practice of active learning in teaching-learning mathematics in some selected Preparatory Secondary Schools of Southern Zone of Tigray Region. More specifically the objective of this study was:

- To investigate the status and practice of active learning in teaching learning mathematics in the study area.
- To examine teachers' and students' Attitudes toward active learning in teaching learning mathematics in the selected schools under study.
- To identify those factors that influences the practice of active learning.
- To recommend appropriate strategies through which the practice of active learning teaching approach in Preparatory Secondary Schools should be enhanced.

To achieve these objectives, the following research questions were prepared.

- i. What is the status and practice of active learning in teaching-learning mathematics in preparatory secondary school of Southern Zones of Tigray Regional State?
- ii. What are the attitudes of mathematics teachers as well as students towards active learning approach?
- iii. What are the factors affecting the practice of active learning approach in teaching - learning of mathematics?
- iv. What can be done to enhance the practice of active learning in teaching-learning mathematics in preparatory secondary schools?

Accordingly, attempt has been made to answer the basic research questions raised above. Hence in order to get answer for the above research questions; questionnaires (for both

teachers and students), interviews (for teachers only), observation and documentary sources were used to collect data from 373 students and 12 mathematics teachers. In addition to this descriptive survey design was selected as a research design for the study. In line with this four Preparatory Secondary Schools were selected as a subject of the study by using simple random sampling techniques.

Hence, to analyze the collected data both qualitative and quantitative data analysis techniques were used. For the quantitative data collected through questionnaire/ closed-ended questionnaire/ percentage, mean, standard deviation and paired sample t-test were selected. Whereas the data collected through observation, interview, open-ended questionnaire and document analysis were analyzed qualitatively by descriptive statements. Accordingly, the major findings of the study were presented as follows:

The study revealed that almost all of the respondent teachers were interested to teach mathematics through active learning and they had good understanding of active learning approach except some problems on how to apply it in the class room. In addition to this the majority of the respondent teachers argued that active learning is appropriate to teach mathematics in preparatory secondary schools, it create opportunities to share experience and encourage friendship among learners. But the majority of the respondent teachers (62.5%) have reported that as they did not take a continuous training how to use active learning in teaching mathematics class.

The study indicated that lecture/explanation, and oral questioning and answering method of teaching were used dominantly in teaching mathematics. Whereas demonstration, discussion, group work and problem solving instructional teaching methods were used sometimes. Moreover the study indicated that Role play, Inquiry learning, Project work and Discovery learning were never used in the teaching learning process. Generally, the study revealed that most of the respondent teachers employ the teacher-centered method of teaching in their teaching-learning process. In other words the majority of result indicated that respondent teachers used rarely active learning approach in teaching mathematics in the study area. In addition to this the study indicated that the participation of students was very low during the teaching learning process. That is, students' activity were not observed in doing class room activities, making group discussion actively and doing other activities which were given by their teacher rather than copying and listening for their teacher activities.

Moreover from the analysis of the collected data, the major factors that affect the practice of active learning approach in teaching-learning mathematics in the class room were: lack of professional support, encouragement and understanding of the administration towards active learning, lack of resources (like reference books especially for the new text book, computer service and other supportive teaching materials), lack of teachers' interest towards their profession, lack of students' understanding and their attitude towards active learning, tendency of teachers towards the traditional teaching method , shortage of time ,volume of the text books (its contents are too vast), lack of students' to attend effectively in the class room, students' lack of confidence (frightened), lack of Students' basic knowledge of mathematics from the lower grade, lack of Students' awareness of doing mathematics exercise regularly, students lack of the habit of doing in groups , large class size and finally teachers teaching style as well as teachers have not the habit of checking students work whether students were understood them well or not.

5.2. Conclusion

As repeatedly mentioned above, the main purpose of this study was to investigate the status and practice of active learning in the teaching -learning mathematics and to identify those factors that influence the practice of active learning in teaching-learning mathematics in some selected Preparatory Secondary Schools of Southern Zone of Tigray Region. Accordingly the following conclusions are made based on the findings obtained from the study. Even though most of the respondent teachers had good understanding of active learning; teaching-learning mathematics through active learning in the study area was affected by:

- Lack of students basic knowledge of mathematics from the lower grade,
- Large class size,
- Lack of students' interest towards active learning as well as the subject,
- Teachers tendency towards the traditional teaching method,
- Students have not the habit of doing in groups, pre-reading and revision after they have learnt from the elementary class,
- Volume of the text books, its contents is too vast,
- Lack of students attending effectively in the class room, lack of awareness of doing mathematics exercise regularly and lack of confidence (frightened),

- And finally shortage of reference books especially for the new text book, shortage of time as well as other instructional materials which are appropriate to teach mathematics through active learning, for example computer service, teaching aids etc, were the main problem observed in the research area.

5.3. Recommendation:

Finally, based on the findings and conclusions drawn above the following recommendations were recommended for the improvement of teaching-learning mathematics through active learning approach in the study area.

- It is good if teachers give high emphasis to help students in giving additional support like giving tutorial class, advising students to read different reference books which are related to their grade levels, to motivate and group students in the class room.
- Teachers and school support staff have to be trained in producing instructional materials using raw materials which are available in school locality.
- It is important to give continuous and extensive orientation to mathematics teachers on how to practice active learning approach in mathematics class.
- Since active learning approach requires pre-requisite knowledge. Therefore, it is important if the students have good back ground knowledge of mathematics as we as to itself (active learning approach) from the early class.
- It is good to minimize the number of students in each class.
- It is important to introduce the purpose of active learning for the students so as to facilitate independent learning, to develop self-confident, to make students the agent of their own learning and to involve them in practical activities.
- It is important if teaching encompass a combination of multi- instructional teaching strategies.
- Reference materials in the library should be available in enough quantity and quality,

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Appendices

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Appendix A: Questionnaire to be filled out by teachers

Dear respondents: the main purpose of this questionnaire is to collect relevant data about the status and practice of active learning in teaching -learning mathematics of grade eleven and twelve in 2003E.C. So, it is believed that this research becomes effective and meaning full to the extent that all the respondents show their cooperation to answer all the questions carefully based on their experience. The data obtained from this questionnaire is used for the purpose of this study only and then kept confidentially. Therefore, you are kindly requested to respond to all questions based on the instruction given.

Thank you in advance for your cooperation!!

Preliminary information

Name of your school_____

Woreda _____

Qualification_____ Grade(s) you are teaching now_____ Sex_____

Teaching experience_____

Direction: items related to your understanding and experience on active learning is provided below. Please read them carefully, and then after you have read each question give your response by circling the letter of your choice or by writing on the space provided when necessary.

1. Are you interested to teach mathematics by active learning approach?
A. Yes B. No
2. How often do you assign your students to work in groups?
A. always B. some times C. rarely D. not at all

3. How do you monitor the progress of your students work while you are implementing active learning approach?
- A. By asking students to provide regular reports about their progress
B. By visiting each group while they are working to check on progress and help where necessary
C. By asking students to provide final products of their group work
D. If any other, specify:
-
4. Did you take a continuous training on how to use/practice active learning in teaching mathematics?
- A. Yes B. No
5. If your response to question 4 is “Yes” how frequent do you apply the objective of the training in your daily lesson in teaching mathematics?
- A always B. some times C. not at all
6. If your response to question 5 is “B” or “C”. please explain your reason(s)
-
7. If your response to question 4 is ‘No’ do you believe that you need some training/ orientation on how to practice active learning in teaching mathematics?
- A. Yes B. No
8. If your response to question 7 is ‘No’ please explain your reason(s):
-
9. Do you think that the text book (mathematics text book) is prepared in such a way that it is easy organized to use active learning approach?
- A. Yes B. No
10. If your response to question 9 is ‘No’, please give your reason on how should it prepared?
-
-

11. How often do you encourage your students in active learning approach?

A. always B. some times C. rarely D. Not at all

12. To what extent active learning approach in mathematics class involve students in the teaching learning process?

A. high B. moderate C. low

13. What are the major factors that affect the practice/implementation of active learning in teaching-learning mathematics in your school?

14. What do you think is the solutions of the problems that you mentioned in question13?

15. What do you recommend or advise in order to have the practice of active learning in teaching learning mathematics in your school in particular and in the country in general?

Part –II

Direction: the following are some of the possible factors that may influence the practice of active learning in teaching mathematics. Please read carefully and based on your opinion indicate tick (✓) mark under the five alternatives given below. The five alternatives are: Strong Agree (SA) = 5, Agree (A) =4 , Undecided (UD) =3, Disagree (DA) = 2, Strong Disagree (SD) =1.

Table 1

No.	Possible factors	SA	A	UD	DA	SD
1	Teachers tendency to the traditional method of teaching has affected the perception of students toward the practice of active learning in mathematics					
2	Large number of students in the class room has affected the practice of active learning in teaching mathematics in your school					
3	Shortage of important materials and teaching aids has no effect for the practice of active learning in mathematics class in your school					
4	Shortage of time to apply active leaning in mathematics class has affected its implementation in your school					
5	Students sitting arrangement has no effect for the practice of active learning in learning mathematics in your school					
6	lack of encouragement and understanding of the administration towards active learning has no effect on the practice of active learning					

If you have any other factors, please specify:

Part-III

Direction: the following items deals with attitude of teachers on active learning. Please read carefully and based on your opinion rate from strongly agree to strongly disagree and give your response by using tick (✓) mark to the corresponding items.

Table 2

No.	Items	SA	A	UD	DA	SD
1.	Teachers lack of interest towards the profession (teaching) has affected the practice of active learning in mathematics					
2.	Active learning creates opportunities to share experience and encourage friendship among students					
3.	The current teachers' training policy has affected the practice of active learning in mathematics class					
4.	Active learning approach is effective in teaching – learning of mathematics in preparatory secondary schools					
5.	Active learning does not enhance self-confidence and independent learning of students					
6.	Active learning enhances active involvement of students in learning instead of passive listening					
7.	Lack of students understanding and attitude towards active learning has affected its practice					

Part-VI

Direction: The following are some of the instructional teaching methods that teachers employ to deliver their subject matter. Please, indicate the extent to which you use the following teaching methods in teaching-learning process by putting a tick (✓) mark in front of each teaching methods under one of the alternatives.

Table 3

No.	instructional teaching methods/strategies	Alternatives			
		always	sometimes	rarely	never
1.	Oral questioning and answering				
2.	Group discussion				
3.	Group work				
4.	Brain- storming				
5.	Role play				
6.	Lecture/explanation				
7.	Demonstration				
8.	Inquiry learning				
9.	Discovery learning				
10.	Problem solving				
11.	Project work				

If you employ other instructional teaching methods, please specify: _____

For those items under table 3 where your response is '**rarely**' or '**never**' please explain your reason:

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Appendix B: Interview prepared for mathematics teachers

The purpose of this Interview is to collect data regarding the status and practice of active learning in teaching-learning mathematics of grade eleven and twelve in 2003E.C. The result of the study will be used basically for research requirement not revealed your identity. Thus you are kindly requested to give your response genuinely and frankly.

Thank you in advance for your cooperation!!

1. How can you understand active learning in general and in teaching mathematics in particular?
2. Do you believe that the current teachers training policy has affected the practice of active learning approach? If yes please justify it.
3. Do you believe that active learning approach in teaching mathematics make students responsible for their own learning?
4. Do you think that the activities suggested in students text book, teachers guide and mathematics syllabus can help students to learn actively /learning by doing?
5. What are the major factors that affect the practice/implementation of active learning in teaching-learning mathematics in your school?
6. What do you think is the solutions of the problems that you mentioned in question13?
7. What do you recommend or advise in order to have the practice of active learning in teaching learning mathematics in your school in particular and in the country in general?

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Appendix C: Questionnaire to be filled out by Students

Dear respondents: the main objective of this questionnaire is to collect information from the representative students of grade eleven and twelve in 2003 E.C to see the status and practice of active learning in teaching learning mathematics. Therefore you are politely requested to fill out the questionnaire. All the information that you provide here in the questionnaire will be kept confidential and will be used for research purpose only. Therefore your assistance and genuine responses are highly valuable for success of the study.

Thank you in advance for your cooperation!!

Preliminary information: please fill the following information's.

Name of your school_____

Sex_____ Age_____ grade_____ stream _____

Direction: please give your response to the following questions by circling the letter of your choice and by writing on the space provided when necessary.

1. How often does your mathematics teacher encourage you to do in groups?
A. Frequently B. Sometimes C. Rarely D. Never
2. To what extent your mathematics teacher design group wok activities to ensure that all your group members actively work together?
A. High B. Moderate C. Low
3. Does your mathematics teacher give you group discussion?
A. Yes, always B. Yes, sometimes C. yes, rarely D. No, never
4. Does your mathematics teacher give you enough time for group discussion?
A. Yes, always B. Yes, sometimes C. yes, rarely D. No, never

5. Does your mathematics teacher arrange a make- up/tutorial class for you in order to develop your group discussion?
- A. Yes, frequently B. Yes, sometimes C. Yes, rarely D. No, never
6. How often does your mathematics teacher advise you to read additional reference books from your library?
- A. Always B. Some times C. Rarely D. Never
7. How do you see/observe learning mathematics through active learning approach/student centered method of teaching?
- A. Excellent B. Very good C. Good D. Bad
8. Students learn mathematics when every activity in mathematics is done by the teacher.
- A. Agree B. Disagree C. Undecided
9. Students learn mathematics when they do any activities in mathematics regularly.
- A. Agree B. Disagree C. Undecided
10. How often your mathematics teachers encourage you to ask unclear question?
- A. Always B. Some times C. Rarely D. Never
11. What factors affect you from actively participating in mathematics class?
- A. lack of encouragement from the teacher and school administration
- B. Since mathematics is difficult subject
- C. Shortage of mathematics text book
- D. If you have any other factor please write here

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Appendix D: Class room Observation check list

Name of the School _____

woreda _____

Grade level _____

A. Observation check list for the Class room activities and conditions

No.	Class room activities and conditions	Alternatives	
		yes	No
1.	Does the teacher asses student's prior knowledge and experience?		
2.	Dose the teacher encourages students to relate theory with practice and skill of participation in the class room?		
3.	Does the teacher give appropriate feedback to the student's based on their response?		
4.	Do students actively involved in the class room activities?		
5.	Does the teacher divided the class room in to groups and encourage students to do class room activities in group?		
6.	Is the sitting arrangement of the students' convenient to perform active learning?		
7.	Are the students actively involved in class activities (e.g. asks or responds to questions, plays a role in group activities)?		
8.	Does the teacher uses appropriate teaching aids suggested in the mathematics syllabus of grade eleven and twelve?		
9.	Does the teacher go round the class room and give support to the students who are doing class room activities?		
10.	Does the teacher give enough time for group discussion?		

B. Observation check list for the instructional teaching methods

No.	instructional teaching methods/strategies	Alternatives			
		always	sometimes	rarely	never
1.	Oral questioning and answering				
2.	Group discussion				
3.	Group work				
4.	Brain- storming				
5.	Role play				
6.	Lecture/explanation				
7.	Demonstration				
8.	Inquiry learning				
9.	Discovery learning				
10.	Problem solving				
11.	Project work				

Furthermore the following elements will be observed in unstructured way.

1. Class room size
 - Its convenience for students (air, light, etc)
2. Class room arrangement
 - Students desk and chair arrangement
 - Teachers chair and desk arrangement
 - Black board set up
3. Curriculum materials
 - Student –text book ratio
 - Teacher- teachers guide ratio
4. Library, pedagogical center and computer services
 - Their size/accommodation
 - Availability of the materials

Appendix E: Result of pilot test for students questionnaire

Id.no	q_1	q_2	q_3	q_3	q_5	q_6	q_7	q_8	q_9	q_{10}
1	4	2	3	3	3	3	3	3	2	3
2	2	3	3	3	3	3	2	2	4	3
3	3	3	3	4	4	3	2	2	4	3
4	3	3	3	2	2	3	3	2	4	3
5	2	2	2	1	2	3	2	2	4	2
6	2	2	2	2	2	2	1	3	3	2
7	4	4	4	3	3	4	4	2	4	4
8	4	3	4	3	3	4	3	2	4	4
9	3	1	4	3	4	1	2	2	2	4
10	4	4	3	3	3	4	2	3	3	3
11	4	3	3	3	4	3	4	2	4	3
12	3	3	3	3	3	3	2	3	3	1
13	2	2	2	2	2	2	2	3	3	2
14	3	3	3	3	3	3	3	2	4	3
15	4	3	3	3	4	3	3	2	4	3
16	3	2	2	2	2	2	2	2	2	2
17	3	3	3	3	3	3	2	2	4	3
18	3	3	2	2	1	2	1	4	2	3
19	4	4	4	3	3	3	2	2	4	3
20	3	3	3	3	3	3	3	3	4	3

Cronbach's Alpha =.816

Where q_i represents number of questions=1, 2, ..., 10

Declaration

I, the undersigned, declare that this thesis is my original work and that all sources of material used for the thesis has been properly acknowledged.

Name of the candidate: _____

Signature_____

Date_____

Advisor: _____Signature_____

Co-advisor_____Signature_____