EFFECTS OF PROBLEM-SOLVING APPROACH ON STUDENTS' ACADEMIC ACHIEVEMENT AND ATTITUDE TOWARDS LEARNING MATHEMATICS : IN THE CASE OF HOTIE GENERAL AND PREPARATORY SECONDARY SCHOOL DESSIE TOWN, AMHARA REGIONAL STATE, ETHIOPIA

MSc THESIS

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Effects of Problem-Solving Approach on Students' Academic Achievement and Attitude towards Learning Mathematics : In the case of Hotie General and Preparatory Secondary School Dessie Town, Amhara Regional State, Ethiopia

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I hereby certify that I have read and evaluated this Thesis entitled "Effects of Problem-Solving Approach on Students' Academic Achievement and Attitude towards Learning Mathematics (Coordinate Geometry):In the case of Hotie General and Preparatory Secondary School Dessie Town, Amhara Regional State, Ethiopia", by Shimels Tefera. I recommended that it be submitted as fulfilling the thesis requirement.

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As a member of the Board of Examiners of the MSc Thesis Open Defense Examination, I certify that I have read and evaluated the thesis prepared by Shimels Tefera and examined the candidate. I recommend that the thesis be accepted as fulfilling the Thesis requirements for the degree of Master of Sciences in Mathematics (Numerical Analysis).

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DEDICATION

I dedicate this project manuscript to my mother Alemitu shagiyaw, my wife Elsa Habtie for their contribution in the success of my life .

STATEMENT OF THE AUTHOR

By my signature below, I declare that this Project is my own work. I have followed all ethical and technical principles of scholarship in the preparation, and compilation of this Project. Any scholarly matter that is included in the Project has been given recognition through citation.

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BIOGRAPHICAL SKETCH

The author was born on January 15,1971 in Dessie city, Amhara region , Ethiopia and attended his primary education at Tigil firie Elementary School and he attended his secondary education at W/O Sihin Senior Secondary School. After completing his secondary School education in 1990 he joined Dessie Teachers Training Institute and he was employed and teaching for six years . He joined St,marry collage distance education and graduated with Diploma in Mathematics in November in 1998. After his graduation he joined Wollo University in the next year in summer program and graduated with Bachelor of Education Degree in Mathematics in September 2003. As his education leads him to teaching, he was employed and teaching Mathematics at Asfawossen Algaworash secondary and preparatory school in Tenta woreda. He joined the postgraduate program at Haramaya University, college of Natural and Computational science in summer program in June 2007 in order to pursue his master of science in Numerical analysis .

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ACRONYMS AND ABBREVIATIONS

CG	Control Group
EG	Experimental Group
HGPSS	Hotie General and Preparatory Secondary school
LM	Lecture method
MOE	Ministry of Education
PSA	Problem-Solving Approach

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ABSTRACT

The purpose of the study was to investigate the effect of Problem-Solving Approach on Students' academic achievement and Attitude towards learning Mathematics . The students of grade 11 of Hotie General and Preparatory Secondary School were selected as a sample for the study using Convenience sampling. Sample size consisted of 94 students who were equally divided into an experimental group (n=47) and a control group (n=47) on the basis of pretest. Experimental (true) is used as a research design in this study. During five weeks instruction, the experimental group received instruction with the problem-solving approach while the control group was taught with lecture method . Data of the study was collected through questionnaire and achievement test. After the treatment, post-test was used to see the effects of the treatment. Results were analyzed using mean, standard deviation, paired t-test and independent t-test. A collected data was processed by SPSS version 20.0. Findings of the study indicated that there was statistical significant difference between students learned by problem solving approach and lecture method in attitude attitude towards learning mathematics and academic achievement in mathematics (coordinate geometry). That is the students learned by problem-solving approach showed a better attitude towards learning on mathematics and showed a better academic achievement in coordinate geometry than the students learned by lecture method . The study recommended that problem solving approach is more effective method of instruction for develop positive attitude on students towards learning mathematics and more effective method of instruction for showed a better academical achievement in mathematics (coordinate geometry) as compared to lecture method of teaching. Therefore mathematics teachers of preparatory school should use problem solving method to improve the academic achievements of the students on mathematics (coordinate geometry) and develop positive attitude towards learning mathematics.

Keywords: Problem-solving Approach, Attitude, and Coordinate Geometry

1. INTRODUCTION

1.1. Background of the Study

Despite the huge efforts and initiatives that have been taken by the Ethiopian Government to improve the quality of education at all levels of educational institutions, there are some constraints that affect the achievement of students in mathematics at secondary and preparatory education. Among the challenges, students' negative attitude towards mathematics is the most significant one (Kebede, 2012). Negative attitude towards mathematics can be considered as a serious problem in the teaching – learning process of mathematics. Even though the Ethiopian Government, at Preparatory Level (grade 11 and 12), has placed a great emphasis on the importance of mathematics and science education as an essential component for the sustainable economic growth of the country (Eshetu,2009). Government policy and implementation strategies in Ethiopia encourage learner-centered, active pedagogy, cooperative learning, and the development of critical thinking and problem solving skills And yet, there is simple evidence that teacher –dominated pedagogy is the norm in Vast majority of Ethiopia secondary school (Derebessa,2006).

In Ethiopia, the current curriculum calls for emphasis on active learning and teaching approach, and therefore demands teachers to employ this teaching learning style. Even educational personnel at different levels are only speaking about the term without mastering it and thereby providing a support system for teachers,is just only half the battle (Derebessa,2006). Education cannot be made more effective without effective teaching. There are so many devices for effective teaching and an effective technique can ensure effective learning. It is being felt that there should be new techniques of teaching and learning (Iqbal, 2004).

Ethiopian educational system paid due attention for science and technology educations; especially for Science, Technology, Engineering and Mathematics (STEM). Related to these education expansion efforts, the Ministry of Education in Ethiopia has published a professional mix guideline based on a 70:30 annual intake ratio favoring placement of students into science and technology programs overprograms in the social sciences and humanities respectively (MoE, 2008). This mainly indicates that how much the country has turned its face to science and technology; and how much consideration the government has given for the advancement of science and technology.

Mathematics in the real sense is a science of space, quantity and change that helps in solving the problems of real life needing numeration and calculation. It also provides opportunities for the intellectual gymnastic of the man's inherent powers (Ravanan, 2004). According to Akinsola and Tella (2003) Mathematics is defined as an important school subject, because it is associated with more academic and or career opportunities. Thus it is a science that studies numbers, shapes, objects and their properties which are needed as basic requirement for all sciences. As to Abu-Hilal (2000) students' perceptions regarding the importance of mathematics exerted a significant effect on achievement. However, many Ethiopian students do not like mathematics and others consider it difficult. The peoples and government of Ethiopia are now struggling to escape out of poverty through accessing to higher education, in particular to science and technology MoE (2010).

In all active learning processes, Ali (2014) mentioned that the students shift from passive listeners and information receivers to active, well-engaged learners, and problem solvers. The objective of learning is to actively engage students in group work and in individual study. The learners'self directed learning gives them the freedom to decide individually and consciously on the learning strategy that helps them accomplish the task. The problem-solving approach in teaching mathematics manifests these key features of active learning process.

Teaching through problem-solving has become a major focus in mathematics education as it helps students develop mathematical knowledge and provides a chance to apply and connect previously learned mathematical concepts and skills. Problem based learning affect positively certain other attributes such as problem solving, information acquisition, and information sharing with others, group works, and communication etc. Again problems solving is a deliberate and serious act, involves the use of some novel method, higher thinking and systematic planned steps for the acquisition set goals. The basic and foremost aim of this learning model is acquisition of such information which based on facts (Yuzhi, 2003 & Mangle, 2008).

Geometry is one of the important branches of mathematics education, because the aim of the geometry teaching is to provide students with the ability of critical thinking, problem solving and a better understanding of the other subjects in mathematics by making the students have a high level of geometric thinking skills (Şahin, 2008). Coordinate geometry is one of the most important and exciting ideas of mathematics. Indeed, it is the most important part of school mathematics. It provides a connection between algebra and geometry through graphs of lines and curves. This enables

geometric problems to be solved algebraically and provides geometric insights into algebra. It brought together nearly all of algebra and geometry using the coordinate plane.

The students` learning difficulties in understanding the concept of mathematics is the abstract nature of mathematics,for that reason students learning mathematics by memorizing (Malmivuori, 2008). and they had difficulties in learning the concepts of mathematics , particularly in coordinate geometry. Hence, this study was focus to teach grade 11 students' in coordinate geometry using problem solving approach to investigate the effects of PSA on their academic achievement and attitude towards learning mathematics.

Thus, the issue is serious and critical. Therefore, understanding the effects of PSA on their academic achievement in coordinate geometry and attitude towards learning mathematics in the study area was important for suggesting the possible practical ways and be enhancing students' achievement success for the future. Thus, it was this issue that initiated the researcher to investigate effect of the problem solving approach on students'attitude and achievement in mathematics, particularly in coordinate geometry in the study area.

1.2. Statement of the Problem

This study investigates the effects of problem-solving approach on students' academic achievement and attitude towards learning mathematics with specific focus on the topic of coordinate geometry. The researcher's experience of teaching mathematics and other school mathematics teachers who had more experience on grade 11 observed that students showed low interest to learn mathematics and particularly in coordinate geometry. Abu-Hilal (2000) said that Ethiopian students do not like mathematics and others consider it difficult and students have a challenge for them to know basic concepts about coordinate geometry and to know methods and procedures for solving problems and mostly asked why students showed low interest to learned coordinate geometry and have got low achievement.Adegun (2013) stated that students generally encountered difficulties in geometry and performed poorly in senior secondary school mathematics lesson. Also, Telima (2011) found out that many students fail to grasp key concepts in geometry and leave mathematics classes without learning the basic terminology. Findings have shown that some factors are identified to make the learning of geometry concepts in mathematics difficult which include: teachers' methods of instruction, geometric language, visualizing abilities (Noraini, 2006 and Aysen, 2012).

Geometry is an important area in the school Mathematics curriculum throughout history; it has had great importance in people's lives, originating with the need of human beings to specify quantities, to measure figures, land and earth, and makes maps. In order to represent and solve problems in topics of Mathematics like coordinate geometry and in daily life situations, sound geometry knowledge is necessary. The National Council of Teachers of Mathematics (NCTM, 2000) has emphasized the importance of geometry in school Mathematics by stating,"Geometry and spatial sense are fundamental components of Mathematics learning." Geometry is one of the most important branches of Mathematics and it is concerned with the properties and relationships of lines, angles, curves and shapes, etc. In addition, it helps them to acquire abilities such as making new discoveries, analyzing problems and making connections between mathematics and real life situations. Regardless of the utility of geometry in real life situations, students continue to dislike the geometrical concepts and hence they perform poorly in examinations.

However, Olatoye (2009) developed and evaluated some of such strategies directed at improving students' attitudes to geometry subjects which include a strong relation between geometry contents and students everyday experiences. In spite of these important, a thorough research revealed the factors that are responsible for students' difficulty in learning geometry to include: lack of background knowledge, poor reasoning skills in geometry, geometric language comprehension, lack of visualizing abilities, teachers' method of teaching, non-availability of instructional materials, lack of proof by students, gender differences among others .

The success of the problem-solving approach depends on the teacher and the students. Teachers need to believe that the focus of learning should be conceptual, rather than procedural. They should also recognize that there is much more to a problem than the answer. Teachers then should recognize that making mistakes is an integral part of learning. On the other hand, students should also recognize that working hard with a problem will ultimately lead to a solution. This can help them view mathematics as a subject which they can actually learn on their own. Allowing student to solve the problem by group enhances their perseverance. Students tend to persevere in solving the problem when they are interacting with their fellow classmates (Colton, 2014).

In Ethiopian context, the Ministry of Education has shown that the problems of mathematics instruction are diverse and multidimensional: Some of the mathematics instruction problems include the traditional teaching approaches followed by mathematics teachers, the existing wrong perceptions

and conceptions on mathematics, lack of reference materials, poor preparation of mathematics teachers, and the absence of encouraging students' prior experiences. The Ministry of Education MoE (2002) underlined the importance of implementing student-centered approaches in teaching at various levels to promote the development of problem-solving capacities and competencies of the students. As a result, this study initiated to investigate the implementation of PSA in preparatory school mathematics classes.

The focus of this study was to investigate the effects of problem-solving approach on students' academic achievement and attitude towards learning mathematics , particularly in coordinate geometry in Hotie general and preparatory secondary school. The emphasis was to determine whether the method of instruction (problem-solving approach) motivates students to learn, enhances their problem-solving ability on coordinate geometry and ultimately improves their academic achievement in coordinate geometry and attitude towards learning mathematics . A study conducted by Basha (2009) showed that problem solving skills, attitude and achievement in mathematics using survey method . A research conducted by Arthur (2014) showed that effects of problem-solving approach on mathematics achievement of diploma in basic education distance learners using mixed research method and Albay (2014-2015) conducted problem solving approach to the performance and attitude in college algebra of college students.

They did not tried to examine the effect of the PSA on students' academic achievement and attitude in mathematics , particularly in coordinate geometry using experimental method of research. This study aim is at filing this gap by investigating the effect of the PSA on students academic achievement and attitude towards learning in mathematics using true experimental method. If these problems continue like this in the future, it is difficult to prepare a generation who is competent especially where the focus of attention is given to mathematics and there must be solutions to these problems and hence research is required.

1.3. Research Questions

The study tries to seek answer for the following research questions.

- What is the effects of the PSA on student's attitude towards learning mathematics ?
- What is the effects of the PSA on student's academic achievement in mathematics , particularly in coordinate geometry after learning through PSA and LM?

- ❖ Is there a significant difference between the academic achievement of students in mathematics (coordinate geometry) learned before or after through PSA?
- ❖ Is there a significant difference between the academic achievement of students in mathematics (coordinate geometry) learned before or after through lecture method ?

1.4. Objectives of the Study

1.4.1. General Objective of the Study

The general objective of the study was to investigate the effects of the problem-solving approach on students'academic achievement and attitude towards learning mathematics, particularly in coordinate geometry.

1.4.2. Specific Objectives of the Study

The specific objectives of this study were to :

- ➢ evaluate the effects of the PSA on student's attitude towards learning mathematics .
- ➢ investigate the effects of the PSA on student's academic achievement in mathematics, particularly in coordinate geometry after learning through PSA and LM.
- ➢ identify whether there was a significant difference between the academic achievement of students in mathematics (coordinate geometry) learned before or after through PSA.
- ➢ identify whether there was a significant difference between the academic achievement of students in mathematics (coordinate geometry) before and after learning through LM

Hypothesis :

- Hypothesis 1: There is no significant difference between the attitude of students towards learning mathematics before or after learning through PSA.
- Hypothesis 2: There is no significant difference between the attitude of students towards learning mathematics by PSA and LM.
- Hypothesis 3: There is no significant difference between the academic achievement of students in mathematics, particularly in coordinate geometry after learning through PSA and LM
- Hypothesis 4: There is no significant mean difference in academic achievement of students in coordinate geometry learned before or after through PSA.

- Hypothesis 5: There is no a significant difference between the academic achievement of students in coordinate geometry learned before or after through LM

1.5. Significance of the Study

One of the roles of quality of education is to prepare students who are competent, motivated, and able to solve problems on their own. Give useful information for mathematics teachers how to teach mathematical contents especially difficult content for students. It contributes towards filling the gap in teaching mathematics to improve students' academic achievement and student's attitude towards learning mathematics. It helps for students to know the effect of problem-solving approach on their academic achievement in coordinate geometry and attitude towards learning mathematics and also helps to give a direction to enhance the academic achievement of students in other related subjects (like physics). Finally, the study may serve as a reference to other researchers who want to do their research in this area and helps for educational experts, policy makers and other concerned stakeholders may use the results of this study in implementing educational policies, strategies and program.

1.6. Scope of the Study

Among students in this school, the researcher deliberately focuses his study on grade 11 students. This is because grade 11 students in the school have showed low interest to learn mathematics and have got low result in assessment, especially in coordinate geometry as the researcher observed from his teaching experience. In grade 11 coordinate geometry students learned circles , parabolas , ellipse and hyperbolas through PSA and LM. Even, if students had difficulties in mathematics generally on grade 11 mathematics contents, the researcher considered to study on coordinate geometry .

The focus of the study was on HGPSS , it was limited the ability of the researcher to generalize the findings to a large population. However, the researcher had attempted to make the study as complete as possible and open for further study. The study is delimited to students of HGPSS who took mathematics courses in the academic year. The discussion and analysis of the study was delimited to the following issues: the methods of mathematics teaching in coordinate geometry through PSA and LM , the students' attitudes toward learning mathematics, and the effectiveness of PSA on students academic achievement and attitude towards learning mathematics ,particularly on coordinate geometry.

Variables are factors that vary, therefore the dependent variable depend on the independent variable (Gay &Airsian, 2011). The key variables for the realization of this study were dependent and independent variables. The independent variables for this particular study were teaching using PSA in coordinate geometry and the LM of instruction. Dependent Variables are the conditions, or characteristics that appears, disappears or changes as the researcher introduces, removes or changes. Students' academic achievement in coordinate geometry and attitude towards learning mathematics were dependent variables for this study.

1.7. Definition of key Terms

Coordinate Geometry: It is a branch of geometry in which two real numbers, called coordinates, are used to indicate the position of a point in a plane.

Lecture Approach: A teacher-centered teaching approach where the learner is a passive recipient of knowledge and the teacher an active transmitter of knowledge.

Preparatory School: is a school designed to prepare students for higher education, in Ethiopia today commonly consists of grade 11 and 12 (MoE, 2008)..

Problem Solving Approach is defined as an approach in teaching in which the students learn the mathematical concepts by engaging themselves in a problem-solving task or activity

Mathematics Achievement: The performance of students in Mathematics as determined by the magnitude of scores gained in Mathematics test and examinations.

Students' Attitude: An attitude is someone's opinion or feeling about something (Rundell, 2002). In this study attitude refers to an opinion or feeling that students indicates on Likert-type opinion statement.

1.8. Organization of the study

This research is organized into five chapters . Accordingly , the first chapter contains the introduction part of the research which comprises background of the study , statement of the problem , general and specific objective (s) of the study , significance of the study , scope of the study , limitation of the study , definition of key terms and organization of the study . The second chapter states the review of related literature . Where as , the third chapter focuses on the methodologies employed to undertake the research. These components are description of study area,research design, population of the study,sample and sampling techniques, sources of data, data collection instruments, pilot study, data collection procedures, methods of instruction, methods of data analysis ,and ethical considerations. Chapter four consisted of results and discussion (data analysis and interpretation process). Finally , the last chapter presents summary , conclusion and recommendations of the study.

2. REVIEW OF RELATED LITERATURE

2.1. Attitude and Achievement in Mathematics

2.1.1. Attitude

Attitude is a central part of human identity. Everyday people love, hate, like, dislike, favor, oppose, agree, disagree, argue, persuade etc. All these are evaluative responses to an object. Hence attitudes can be defined as "a summary evaluation of an object of thought" (Bohner&Wänke, 2002). Attitude is the individual's beliefs about outcomes or attributes of performing the behavior (behavioral beliefs), weighted by evaluations of those outcomes or attributes. Thus, a person who holds strong beliefs that positively valued outcomes will result from performing the behavior will have a positive attitude toward the behavior. Conversely, a person who holds strong beliefs that negatively valued outcomes will result from the behavior will have a negative attitude. In education, attitude is one of the important elements which determine students' success. According to Cetingöz and Özkal, (2009) attitudes affect the students' interaction with their friends, families, school and lessons. Therefore, students' attitude towards the course will add to their success.

In teaching and learning process of mathematics, the attitude towards mathematics is very important. It effects student's achievement in mathematics. There are many ways which affects the attitude towards mathematics, such as the teaching method, the support of the structure of the school, the family and the student's attitude towards school (Barton, 2000). A teacher should attempt to improve the students attitude towards mathematics a lower level provides base for higher studies in mathematics. It also causes effect in achievement of mathematics at secondary school level (Ma and Xu, 2004). Yusoff and Janor (2014) on their study of the generation of an interval metric scale to measure attitude shows that Likert type scale can be used to measure quantitative data on attitude. The literature reviewed shows that learner attitude can be measured using quantitative research approach. They argue that the variables can be expressed in terms of numbers using quantitative approach and the most common rating scale to measure attitude, opinion or feeling is called Likert-scale on scale ranging from (strongly agree to strongly disagree) (Yusoff&Janor, 2014).

2.1.2. Achievement in Mathematics

Achievement in mathematics has been for the past several decades a topic of investigation for researchers around the world concerned with improving the quality of mathematics education.

Mathematics achievement of students in the high school years has been found to be signficant to success in tertiary mathematics and performance in other science subjects, as well as contributing to better career options and quality of life (Barry & Chapman, 2007). There is, however, increasing concern about levels of student mathematics achievement and quality of mathematics education globally (Martin,etal 2000). Students' mathematical academic achievements in secondary school have an influential effect on their performance in college and their future careers. Having a solid background in mathematics helps students develop sophisticated perspectives and offers more career options.

In almost all Ethiopian schools students consider mathematics as a challenging subject. Which cannot be understood is a common phenomenon among students, teachers and parents. But, this is true in many countries too. Mathematics is considered by many individuals as a difficult subject to learn (Fennema& Sherman, 1976). This kind of outlook has a direct relation with achievement. The importance of mathematical learning has repeatedly been emphasized by educators and politicians (Wilkins & Ma, 2002). Both teachers and parents have paid attention to students' performance in mathematics and their progress every year. Achieving well in mathematics, according to Morris (2009), has to do with how students deal with their studies in mathematics and how they cope with or accomplish different tasks given to them by their teachers, bearing in mind the expected standard of performance.

2.2. Coordinate Geometry

Coordinate geometry is one of the most important and exciting ideas of mathematics. In particular it is central to the mathematics students meet at school. It provides a connection between algebra and geometry through graphs of lines and curves. This enables geometric problems to be solved algebraically and provides geometric insights into algebra. It brought together nearly all of algebra and geometry using the coordinate plane. Coordinate geometry is where algebra meets geometry. In secondary school mathematics, most coordinate geometry is carried out in the coordinate plane. Coordinate geometry is that branch of geometry in which two real numbers, called coordinates, are used to indicate the position of a point in a plane. The main contribution of coordinate geometry is that it has enabled the integration of algebra and geometry. This is evident from the fact that algebraic methods are employed to represent and prove the fundamental properties of geometrical theorems. Equations are also employed to represent the various geometric figures. In coordinate geometry,

points are ordered pairs (x, y), lines are given by equations ax +by +c = 0 and circles by equations $(x-a)^2 + (y-b)^2 = r^2$. Thus the simplest, most useful and most often met application of coordinate geometry is to solve geometrical problems. Parabolas, ellipses and hyperbolas also regularly arise when studying geometry (David Hunt,2011).

2.3. Usefulness of Geometry

Geometry is an important area in the school Mathematics curriculum throughout history; it has had great importance in people's lives, originating with the need of human beings to specify quantities, to measure figures, land and earth, and makes maps. In order to understand ideas embedded in geometry problems the ways of teaching learning plays a significant role. Geometry learning is the process of acquiring facts, skills, and methods that can be retained and used as necessary. Geometry learning is also interpreting and understanding geometric facts, concepts and figures in reality. Moreover, it is the process of acquiring facts, skills, methods, interpreting and understanding some geometric concepts such axioms, dimension, symmetry, measurements and constructions (Jones, 2002).

The National Council of Teachers of Mathematics (NCTM, 2000) has emphasized the importance of geometry in school Mathematics by stating, "Geometry and spatial sense are fundamental components of Mathematics learning. They offer ways to interpret and reflect on our physical environment." Geometry allows students to develop insight to understand other mathematical concepts and connect ideas across different areas of mathematics (Muschla 2000). Geometry is one of the most important branches of Mathematics and it is concerned with the properties and relationships of lines, angles, curves and shapes, etc. Geometry helps both male and female students to describe and define the world systematically. In addition, it helps them to acquire abilities such as making new discoveries, analyzing problems and making connections between mathematics and real life situations.

Regardless of the utility of geometry in real life situations, students continue to dislike the geometrical concepts and hence they perform poorly in examinations. However, Olatoye (2009) developed and evaluated some of such strategies directed at improving students' attitudes to geometry subjects which include a strong relation between geometry contents and students everyday experiences. Not only this, students need to develop the attitudes and habits of mind that are considered for meaningful work in geometry. It is therefore the objective of this study to find out the attitudes of grade 11 students towards learning mathematics and academic achievement in coordinate geometry at Hotie general and secondary and preparatory school .

2.4. Problem Solving Approach

Problem solving approach is defined as an approach in teaching in which the students learn the mathematical concepts by engaging themselves in a problem-solving task or activity in which the required solutions and processes are not obviously known. As such, students need to explore on the concepts, develop understanding of the problem, and make connections with mathematical knowledge previously learned, and select appropriate mathematical skill that leads to the solution of the problem. The problem-solving approach places student's into the center of the teaching and learning process. It also provides opportunities to develop active and motivated learning, problem-solving skills, and broad field knowledge. In this approach, students are responsible of their own learning as they are left for some time to understand the problem and to arrive at the solution using appropriate mathematical skills and knowledge. This can be done individually, by pair or by a small-group discussion (SAIDE, 2014).

In a classroom where the problem solving approach is utilized, the teacher poses a thought-provoking problem which may require hands-on activities, illustrations, paper and pencil, or mental mathematics. The teacher allows thestudents to work on the problem individually, by pair or by group, with in a given period of time. The students struggle to solve the problem through concept exploration, inquiry, and application of necessary prior and basic mathematics concepts and skills. After the time has elapsed, students present their ideas or solutions to the class. Each student is given an opportunity to ask questions or to clarify an idea. This allows active discussion to happen until the class has arrived at the correct solution to the problem, hence, learning the concept. Then, the teacher gives a summary of the concepts attached to the problem. Afterwards, students are given similar problems to work on where they apply the concepts and skills they have just learned (Guillory , 2014).

A study conducted in Ethiopia, Bishaw (2011) established that teachers have low level beliefs regarding the use of a problem-solving approach and that teachers are employ alecture approach. A central tenet of reforming pedagogy in mathematics has been that students benefit from comparing, reflecting on, and discussing multiple solution methods (Charalambous& Strawhun,2005). Educational reforms in mathematics advocate that the teacher acts more as a facilitator, encouraging students to share and compare their own thinking and problem solving methods with other students (Rittle-Johnson & Star, 2007). Accordingly, one of the facilitator's roles when teaching mathematics

using a problem-solving approach is his or her ability to encourage students to discuss their solutions with their peers during mathematics lessons.

2.5. Traditional Approach

A traditional approach was used in normal classes at the school. It started with concepts and principles and ended up with exercises. It was teacher-centered instruction with the teachers as the source. The teachers identify the learning goals and use lectures and discussions to achieve them, and then provide students with exercises, such as problems, to practice what they have learned. The students work individually, and listen to the teacher, and they follow the teacher's instructions. The students can receive answers for their questions from the teacher. The teacher does not pose any meta cognitive questions, or let students work within groups. The teacher leads students to achieve the learning goals but not guide them(Gresham, 2007).

2.6. A Problem-Solving Approach and Mathematics' Achievement

Teaching mathematics through a problem-solving approach provides a learning environment for learners on their own, to explore problems and to invent ways to solve the problems. According to (Masingila& Raymond (2011), the ultimate goal of a problem-solving approach in teaching mathematics is to enable learners to develop understanding of concepts in mathematics, and there by improve their academic achievement in mathematics. Teaching through problem-solving has become a major focus in mathematics education as it helps students develop mathematical knowledge. According to D"Ambrosio (2003), proponents of teaching mathematics through problem solving base their pedagogy on the notion that learners who encounter problematic situations use their existing knowledge to solve those problems, and in the process of solving the problems, they construct new knowledge and new understanding. In effect, the outcomes of D"Ambrosio"s (2003) study indicate that, teaching mathematics through a problem-solving approach offers the promise of fostering students learning .

In a study, Kousar (2010) sought to determine the effect of a problem-solving approach on academic achievement (performance) of mathematics learners at the secondary level. Using a sample size of 48 learners Kousar (2010) equally divided them into an experimental group and a control group on the basis of an assessment he conducted. The experimental group was then taught over a period of six weeks based on a planned problem-solving approach. The control group continued with the

instructional approach that they had prior to being identified as the control group. After the intervention, an assessment was used to see the effects of the intervention. A two-tailed t-test was used to analyze the data, which revealed that both the experimental and control groups were almost equal in mathematics knowledge at the beginning of the experiment. However the experimental group outscored the control group significantly on the assessment following the intervention.

Proposing how to organize activities in a problem-solving approach classroom, Allevato and Onuchic (2007) suggest and explain the following seven steps to be followed by the teacher:

1. Form groups and hand out the activity. The teacher presents the problem to the learners, who, divided into small groups, read and try to interpret and understand the problem. It should be emphasized that the mathematical content necessary, or most appropriate, to solve the problem has not yet been presented in class. The problem proposed to the learners, which we call the generative problem, is what will lead to the content that the teacher plans to construct in that lesson.

2. Observe and encourage. The teacher no longer has the role of transmitter of knowledge. While learners attempt to solve the problem, the teacher observes, analyzes learners‟ behavior, and stimulates collaborative work. The teacher mediates in the sense of guiding learners to think, giving them time to think, and encouraging the exchange of ideas among learners.

3. Help with secondary problems. The teacher encourages learners to use their previous knowledge, or techniques that they already know, to solve the problem, and stimulates them to choose different methods based on the resources they have available. Nevertheless, it is necessary to assist learners with their difficulties, intervening, questioning, and following their explorations, and helping them to solve secondary problems when necessary. These refer to doubts presented by the learners in the context of the vocabulary present in the statement of problem; in the context of reading and interpretation; as well as those that might arise during theproblem solving, e.g. notation, the passage from vernacular to mathematical language, related concepts, and operational techniques, to enable the continuation of the work.

4. Record solutions on the blackboard. Representatives of the groups are invited to record solutions on the blackboard. Correct as well as incorrect solutions, as well as those done for different processes, should be presented for all the learners to analyze and discuss.

5. Plenary session. The teacher invites all learners to discuss solutions with their colleagues, to defend their points of view and clarify doubts. The teacher acts as a guide and mediator in the discussions, encouraging the active and effective participation of all learners, as this is the richest moment for learning.

6. Seek consensus. After addressing doubts and analyzing resolutions and solutions obtained for the problem, the teacher attempts to arrive at a consensus with the whole class regarding the correct result.

7. Formalize the content. At this moment, called "formalization", the teacher makes a formal presentation of the new concepts and contents constructed, highlighting the different operative techniques and properties appropriate for the subject".

It can be deduced in the seven outlined steps that in a problem-solving approach of teaching mathematics, the problem is proposed to the learners before the mathematical content necessary or most appropriate for solving it (planned by the teacher according to the program for that grade level) is formally presented. Thus, the teaching-learning of a mathematical topic begins with a problem that expresses key aspects of this topic, and mathematical techniques should be developed in the search for reasonable answers to the problem given. The steps also define a more-challenging role for the teacher. This approach to teaching is different from what exists in a teacher-centered approach classroom.

2.7. The Learners'Attitude towards the Teaching and Learning of Mathematics.

Good performance in Mathematics is an essential requirement for the learners to gain admission to scientific and technological professions. Negative attitudes are the results of frequent and repeated failures when dealing with mathematical tasks (Mata et al., 2012). Children in lower grades have a positive attitude towards Mathematics. However, as they progress to higher grades their attitude become less positive. This may be due to the pressure to perform well and demanding tasks of the higher grades. The current study focused on an alternative method that could help to change learners' attitude towards Mathematics, in particular coordinate geometry. Researchers show that learners with positive attitudes perform better in the subject (Mata et al., 2012). The learners' attitude may be improved by using teaching and learning methods that are interactive and practical. Georgiou et al. (2007) showed that high academic achievement in mathematics could serve to predict a positive

attitude towards mathematics, but such an attitude could not predict stronger achievement. However, these authors emphasize the role of teachers and schools in changing attitudes stating that, mathematics achievement could be improved by, for example, better teaching methods, more motivated teachers or better course books, which has as its corollary the improvement of attitudes towards mathematics and results in better achievement in mathematics.

Researchers in Mathematics have focused on and assisted with the importance of learners making sense of what they are learning in schools (Reed &Kirschner, 2010). The understanding of the subject matter is what motivates supports and engages the learners in the construction of Mathematical knowledge. Mathematics in terms of learning is challenging, when learning support is insufficient. Learners learning interest may easily decrease and cause increase in negative attitude. Mathematics is a primary requirement for the application of engineering and also a language of science.

Therefore it is vital for learners to develop positive attitude in the subject (Tseng et.al. 2011). Maat and Zakaria (2010) stated that, the way students perceive their teachers' characteristics will also affect their attitudes towards mathematics. Vaughan (2002) identified that there is a significant relationship between learning environment and attitude towards mathematics. Students with a higher perception of the learning environment have a more positive attitude towards mathematics. Generally, attitude towards Mathematics defines the accumulation of "liking" or "disliking" of mathematics, a tendency or disposition to engage in or avoid mathematical activities (Yara, 2009). It plays a vital role in the teaching and learning processes of mathematics (Farooq& Shah, 2008). The studies (Bayaga and Wadesango, 2014) pointed out that students having positive attitude achieved better in achievement.

According to Effandi & Normah (2009), students' attitudes towards mathematics are closely related to their attitude towards problem-solving in general; negative attitudes need to be overcome, so that students will not suffer from poor problem-solving skills later in life. Olatunde (2010) opined that the process of learning depends not only on family factors but also of students' personal characteristics that are naturally correlated with family characteristics but have an effect on their own. Therefore, in order to analyze achievement, some students' personal characteristics must be taken into account. Research indicates that students may hold negative attitudes towards mathematics for several reasons, including the difficulty and abstractness of mathematics (Malmivuori, 2008), a non-supportive classroom climate (Samuelsson & Granström, 2007), and a lack of teacher support (Akey, 2006). Research studies also show that when students perceive the learning environment as supportive and

positive in general, they are more likely to develop positive attitudes (Monteiro, &Peixoto, 2012). A more recent study in a college setting also shows a positive change in students' attitudes towards mathematics as a result of an intervention (Hodges & Kim, 2013).

2.8. Students' Attitudes towards Geometry

The attitudes of pupils can be influenced by the attitudes of the teacher and his/her method of teaching. Studies done by Thompson (1993) had shown that the teachers' method of geometry teaching and his/her personality greatly accounted for the students' positive attitude towards geometry and that without interest and personal effort in learning geometry by the pupils, they can hardly perform well in the topic. According to Betiku (2001), teachers' content knowledge has a significant impact on students' performance. The quality of instruction is one of the greatest influences on the students' acquisition of geometry knowledge in mathematics classes. Chappell (2003) said, "Individuals without sufficient backgrounds in mathematics or mathematics pedagogy are being placed in middle school mathematics classrooms to teach". In this study, the researcher was focus on secondary and preparatory school students' attitudes towards learning of geometry (CG) as another reason behind students' poor performance in geometry. Geddes and Fortunato (1993) documented that many students encounter difficulties and performed poorly in geometry.

2.9. Summary of Related Literature

In this section the ideas described in the literature review are summarized. Attitude is a central part of human identity. Everyday people love, hate, like, dislike, favor, oppose, agree, disagree, argue, persuade etc. In teaching and learning process of mathematics, the attitude towards mathematics is very important. There are many ways which affects the attitude towards mathematics, such as the teaching method, the support of the structure of the school, the family and the student's attitude towards school (Barton, 2000). A teacher should attempt to improve the student's attitude towards mathematics a lower level provides base for higher studies in mathematics. Mathematics achievement will mean the performance of pupils in mathematics as determined by the magnitude of scores gained in mathematics test and examinations. Mathematics achievement of students in the high school years has been found to be significant to success in tertiary mathematics and performance in other science subjects, as well as contributing to better career options and quality of life (Barry & Chapman, 2007). In almost all Ethiopian schools considering mathematics as a challenging subject which cannot be

understood is a common phenomenon among students, teachers and parents. In secondary school mathematics, most coordinate geometry is carried out in the coordinate plane methods.

Coordinate geometry is one of the most important and exciting ideas of mathematics. In particular it is central to the mathematics students meet at school. Thus the simplest, most useful and most often met application of coordinate geometry is to solve geometrical problems. Circles, parabolas, ellipses and hyperbolas also regularly arise when studying geometry (David Hunt, 2011). Geometry allows students to develop insight to understand other mathematical concepts and connect ideas across different areas of mathematics (Muschla 2000).

Problem solving approach is defined as an approach in teaching in which the students learn the mathematical concepts by engaging themselves in a problem-solving task or activity. In this approach, students are responsible of their own learning as they are left for some time to understand the problem and to arrive at the solution using appropriate mathematical skills and knowledge. This can be done individually, by pair or by a small-group discussion (SAIDE, 2014). A study conducted in Ethiopia, Bishaw (2011) established that teachers have low level beliefs regarding the use of a problem-solving approach and that teachers are employ a traditional (conventional) approach. According to (Masingila& Raymond (2011), the ultimate goal of a problem-solving approach in teaching mathematics is to enable learners to develop understanding of concepts in mathematics, and there by improve their academic achievement in mathematics.

Allevato and Onuchic (2007) suggest and explain the following seven steps to be followed by the teacher to organize activities in a problem-solving approach classroom:1. Form groups and hand out the activity. 2. Observe and encourage. 3. Help with secondary problems. 4. Record solutions on the blackboard. 5. Plenary session. 6. Seek consensus.7. Formalize the content. Researchers show that learners with positive attitudes perform better in the subject (Mata et al., 2012) . The learners' attitude may be improved by using teaching and learning methods that are interactive and practical. Mathematics is a primary requirement for the application of engineering and also a language of science. Therefore it is vital for learners to develop positive attitude in the subject (Tseng et.al., 2011). A more recent study in a college setting also shows a positive change in students' attitudes towards mathematics as a result of an intervention (Hodges & Kim, 2013).

3. RESEARCH DESIGN AND METHODOLOGY

3.1. Description of Study Area

This study was conducted at Hotie secondary and preparatory school, Dessie town Amhara region located 401 km from Addis Ababa in the north-east of Ethiopia. This school is a governmental secondary and preparatory schools. In the town, there had been two secondary and preparatory school. The school was selected purposefully for easy access to gather information from the target population and the researcher is working and familiar with the area.

3.2. Research Design

A research design is described as the procedure for conducting a research. It indicates the general plan how the research is set up (McMillan & Schumacher, 2010). The research design enables the researcher to draw valid conclusions and to answer the research questions (McMillan & Schumacher, 2010). The nature and the objectives of the problem to be studied and the means of obtaining information are the most important factors to be considered in order to choose the appropriate research design. This research is an aim to investigate the effect of the problem-solving approach on students' academic achievements and attitudes in mathematics. In this study ,the researcher used quantitative research method, because quantitative research method is a research method that provides a measure of how people is think, feel or behave in a certain way and uses statistical analysis to determine the results. Method for this study is experimental research method.

Therefore pretest and post-test experimental design was used when participants were studied before and after the experimental manipulation. That means the researcher tested the participants prior to the experimental manipulation, perform the experimental manipulation, and test the participant after the manipulation to see what changes occurred. The experimental group was taught through problem-solving approach in coordinate geometry and the control group was taught only in the normal traditional case. Treatment took for five weeks (two times for a week for 1:30 for each group) on the concept of coordinate geometry by using problem solving approach at each part of the portion for experimental group and giving instruction for control group using traditional method. The experimental and control group were taking the same course with the same teacher.

3.3. Population of the Study

According to McMillan and Schumacher (2010), a population is a large group of elements, that conform to specific criteria, and to which the researcher intended to generalize the results of the research. The target population in this study was all grade 11 students who learn at Hotie secondary preparatory school in academic year. There were 567 grade 11 students with 308 male students and 259 female students.

3.4. Sample and Sampling Techniques

The sample of data for this study was students who were selected from the three grade11 section A, B and C students. The sampling method of the study to select students of grade 11 was convenience sampling. According to Mertler and Charles (2011), convenience sampling takes groups of participants that simply happen to be available. Three Sections were selected from the population using convenience sampling. The researcher constructed pretest from grade 10 coordinate geometry because this was a pr-requisite knowledge for them. Based on the pretest result the researcher arranged the result in decreasing order and systematic labeling of the students was done into two groups. In addition to this, Students were classified at each class as lower achievers, medium achievers and higher achievers relatively based on their grade 10 national examination results. This classification was done in the school by school administration. These have to show the students as much as possible grouped equally in their academic levels.

Table 1: Target population and Sample Size for Control and Experimental groups

Target population			Group	Sample size		
M	F	T		M	F	T
308	259	567	Experimental	25	22	47
			Control	28	19	47
			Total	53	41	94

Sharma (2000), as cited in Atakilty, suggests that it is better to take 10 up to 20 percent of the accessible population for the sample. With regard of this from 567 students of grade 11 who taught in HGPSS 94 (about 16.5%) of them were selected approximately.

3.5. Sources of Data

In this study, the researcher used both primary and secondary sources of data in order to get in-depth information from students about the effect of using PSA on students academic achievement and attitudes towards learning mathematics , particularly coordinate geometry .

3.5.1. Primary Sources of data

The primary sources of data were sample students selected from grade 11 in the school. The data were collected by administering a questionnaires directly both pretest and post-test to the sample students.

3.5.2. Secondary Sources of data

The secondary sources of data were helpful in digging and describing information about what has happened and what was happening . Depending on the grade 11 mathematics curriculum or syllabus of a Ministry of Education of Ethiopia, the researcher used the teacher's guide, text book and others different reference books such as extreme mathematics, modern mathematics to identify the concepts and sub-concepts of coordinate geometry. And also used from different published and unpublished materials such as research articles, websites, recent publications, relevant books and journals to strength the task of the research .

3.6. Data Collection Instruments

The data collection instruments help the researcher to investigate information about what he wants to study. To obtain information for this study the researcher used quantitative data. The data was collected from participants of the control group (CG) and the experimental group (EG) using pretest and post-test and questionnaires.

3.6.1. Pretest and post-test

One of the methods of data collection was the pretest and posttest. Experimental pretest and post-test with control group research design were used to investigate the students achievement .

Pretest

The test was given at the beginning of the experiment for all the sample students. It was used to form equivalent groups by using the result of the test . The result of the pretest was arranged in decreasing order and systematic labeling of the students was done into two groups . This was chosen intentionally to get a group with equivalent mean score and standard devotion . The test having 15 questions for the pretest was prepared by the researcher. The pretest was constructed from grade 10 mathematics content which contains the per requite knowledge for coordinate geometry. Before the pretest questions were given to the students with the help it was evaluated by grade 10 mathematics teachers and department head to evaluate content validity of the test .Then the comments were incorporated . The results of the test were analyzed using quantitative data analyzing methods by using independent t-test and paired sample t-test of (SPSS. 20.0 of windows) .

Post-test

The post-test was used to evaluate the effect of the PSA on students' academic achievement in mathematics (coordinate geometry) by comparing the results of the students who were taught in lecture method and PSA and to evaluate the students' current academic achievement in coordinate geometry. The test was constructed from grade 11 mathematics of coordinate geometry. The test was given for two groups. The results of the test were analyzed using quantitative data analyzing methods by using independent t-test and paired sample t-test of (SPSS. 20.0 of windows).

3.6.2. Questionnaires

The researcher has applied the attitude scale questionnaires to the experimental and control group to collect data. The questionnaires were in a five point Likerts scale questionnaires form. Yusoff and Janor (2014) on their study of the generation of an interval metric scale to measure attitude shows that Likert type scale can be used to measure quantitative data on attitude. The literature reviewed shows that learner attitude can be measured using quantitative research approach. They argue that the variables can be expressed in terms of numbers using quantitative approach and the most common rating scale to measure attitude, opinion or feeling is called Likert-scale on scale ranging from (strongly agree to strongly disagree) (Yusoff&Janor, 2014). The questionnaire was prepared in English and translated into the Amharic in order to alleviate the communication barrier due to

language. The questionnaires were applied before using the instruction of PSA to determine the students' attitude towards learning mathematics . This helped to know the students current feeling on learning mathematics. And the questionnaire was used after the instruction of the coordinate geometry to assess the effect of PSA on students' attitude towards learning mathematics (coordinate geometry). The questionnaire was worded both in the positive and in negative sense ranging from "Strongly agree" to "Strongly disagree". For the positive sense a question may have value 5 that was assigned to "Strongly agree", decreasing values of 4,3,2,1 were given to the other questions, where "Strongly disagree" was assigned the value 1. The results of the questions were analyzed using quantitative data analyzing methods by using paired samples t-test (SPSS, Version 20.0) was applied. The questionnaire for students (self-report) was structured and used to collect data about the entire status of the issue under investigation.

3.7. Pilot Study

The pilot study is the trial run of the data-collection using a small group of learners from the population (Mertler & Charles, 2011). The main purpose of the pilot study is to check on suitability and the clarity of the questions on the instruments designed, relevance of the information being sought and the language used. It is necessary to pilot the test instrument to make it reliable and valid. Before administering the instrument of data collection, the attitude questions were evaluated by the school English teachers to check the language used and grade 11 mathematics teachers observed the sense of the questions. The pretest questions were evaluated to determine content validity by department head of mathematics and three other mathematics teachers with more than 10 years of teaching experiences teaching in grade 10 were asked to validate the test items and piloted for 20 (male 10 and female10) students which were selected randomly from one section of grade 11 of HGPSS. Based on the feedback they were corrected before they were administered to experimental and control group.

The pilot test of post-test was conducted to 20 students (male 10 and female 10) which were selected randomly from one section of grade 12 of HGPSS. The reason for the selection of the pilot test sample was that grade 11 students were not taught the coordinate geometry lesson before the pilot-test was administered, but grade twelve (12) students have learned the unit in grade eleven (11). The selected sample students for the pilot test were not included in the sample group of the experiment. To increase the validity of this study,the questionnaire was first piloted to determine whether it elicited the intended responses (Hollway and Jefferson, 2007). Gay and Airasian (2000) propose that random

selection of participants and random assignment to treatment and control groups are powerful approaches to overcoming threats to internal validity.

To test for reliability, the study used the internal consistency technique by employing Cronbach‟s Coefficient Alpha test for testing a research attitude scale tool and to determine the reliability of pre and post test post test. The reliability of the pretest measure was 0.74 which indicated that the instrument was acceptable and the post-test Cronbach‟s Coefficient Alpha, α value was 0.83 which indicated that the instrument was good reliability. The Cranach's alpha was also used to measure the internal consistency of attitude questionnaire and a value of 0.98 was arrived at, which indicated that the instrument was excellent reliability. The questionnaire was employed to measure the attitude of learners towards learning Mathematics. The questionnaire measured the general attitude of learners towards Mathematics, both positive and negative. Gliem (2003) concluded about the set the criteria for the coefficient of reliability, α. They concluded that α values 1.0- 0.9-excellent, 0.9-0.8-good, 0.8-0.7-acceptable, 0.6-0.7-questionable 0.5-0.6-poor and < 0.5 unacceptable coefficient of reliability.

3.8. Data Collection Procedures

The researcher was taken a letter from the Haramaya University postgraduate program Directorate and this letter enabled the researcher to get a research permit from the school. Before distributing the questionnaire, the researcher was contacted with Dessie city education office to got letter of permission and recognition. Then, the researcher went to school and made contacted with school principals to get accurate information regarding the population. All the respondents were informed about the purpose of the study and how to complete the questionnaire. This was done through the cooperation of school in informing respondents. The questionnaires for the respondents' were distributed by the researcher and department head of mathematics and other three grade 11 mathematics teachers.

3.9. Methods of Instruction

For this study, the data was collected from grade 11 students of HGPSS. A self-prepared pretest was administered to 94 sample students. On the basis of achievement scores in the pretest, the students were assigned to either the experimental group or control group through random sampling. Each group consisted of 47 students. The sample students of the study were grouped into two. The first group was control group (CG) and the second group was experimental group (EG). The lesson was considered

grade 11 Mathematics according to mathematics syllabus from the Ministry of Education (MOE). The coordinate geometry section content was instructed for all groups of students .This includes the sup topics straight line, circles, parabolas, ellipse and hyperbola. The instruction was given for five weeks. The contact time with each group was two times per week for 1:30 (one hour and thirty minutes) per a period.

The content was chosen intentionally because coordinate geometry is a part of geometry and provides a connection between algebra and geometry and the students had showed difficulty to solve problems of coordinate geometry as the researchers observed from the teaching experience in the school, so to understand the basic concepts and to be able to solve problems of coordinate geometry, students need to applied PSA. And, it is part of grade 11 mathematics content which was given for the first time without teaching in the previous grade levels.

The experiment was conducted before the actual class room instruction of the content. The breakdown of the contents was made according to the syllabus prepared by MOE of grade 11 and the researcher prepared course plan contained only the content of coordinate geometry (Appendix I) and for each instructional period a lesson plan was prepared (Appendix J) based on the designed course plan. The instructional material for the groups was prepared by the researcher. Likewise, the researcher instructed the two groups. The experimental group was taught using a series of lesson plans put together with the help of Allevato and Onuchic (2007) suggest and explain seven steps to be followed by the teacher:

The control group was taught using the lecture methods. For experimental group (EG), it was designed their own teaching module and annual plan that guide the lesson of PSA . The total classes' period required for this lesson was 21 periods and the instruction was taken for two days per a week for each group.

The students in the experimental and control group were taught the same progression of curricula, following the same syllabus. The control group was taught by conventional method while the experimental group was taught by problem-solving approach. Immediately after the treatment ended, a self developed post-test was administered to both the experimental and control groups. The results of this post-test were used to evaluate the effectiveness of the problem-solving method versus lecture method over time.

3.10. Methods of Data Analysis

This section presents the statistical methods used to treat the data obtained from sample of grade 11 students. The data gathered from participants was analyzed based on the nature of the data. From the nature of the researchthe quantitative data analysis method was used to analyze the data which was gathered from questionnaire and pretest and post-test. The data collected was analyzed using descriptive and inferential statistics. Descriptive statistics transform a set of observations into numbers that characterize the data and is used to summarize, organize and reduce large numbers of information (McMillan & Schumacher, 2010). On the other hand, inferential statistics assisted a researcher to draw inferences regarding the hypothesis about the population parameter (McMillan & Schumacher, 2010). He also used the SPSS to analyze the quantitative data (Sample 2010). The current study also used a questionnaire on Likert type scale to measure learners' attitude towards learning coordinate geometry and SPSS was used to analyze the quantitative data.

The data collected from the sample students through questionnaire was tallied, organized and tabulated to facilitate analysis. The pretest-post test scores of the experimental and comparison group were evaluated using independent samples t-test. The paired sample t-test was used to determine mean difference between the pretest and post attitude of experimental and control group,from pretest to posttest within the same group was calculated using the paired samples t-test. The same statistical tool was employed in determining the difference between the attitudes of the two groups of students towards CG before and after conducted of the study. The data was analyzed statistically and taken into t-test using (SPSS, version 20.0) and the output of the analysis of the data was tabulated and interpreted. Depending up on the findings, summary, conclusion and recommendation was given at the end. Using a computer program for data analysis helped us "build levels of analysis and see the relationship between the raw data and the broader themes" (Creswell, 2013).

3.11. Ethical Considerations

The researcher taken letter of permission and approval from Haramaya university post graduate program Directorate and City Education office (CEO). Research ethics refers to the type of agreement that the researcher enters into his/ her participants. Ethical consideration plays a role in all research studies and all researchers must be aware of and attended to the ethical considerations related to their studies. The purpose of the research was clearly explained to Dessie CEO so as to get letter of approval to school administrator, respondents and other stakeholders of the school. The researcher

introduced the purpose of the study to the respondents as it isused for academic purpose and requested the respondents to participate in the study on a voluntary basis. The researcher did not coerce (forced) any of the participants to participate in the research study. Therefore the researcher was used appropriate steps to adhere to strict ethical guidelines in order to uphold participants‟ privacy, confidentiality, dignity, rights, and anonymity.

4. RESULTS AND DISCUSSION

This chapter deals with the data collected using pretest and post-test and questionnaire which were tabulated, presented and analyzed in different sections based on the specific objectives of the study and the nature of the data. This study investigates the effects of PSA on student's academic achievement in coordinate geometry and attitude towards learning mathematics of Hotie General and Preparatory Secondary School.

4.1. Analysis of the Comparison of the attitude of students towards learning mathematics before Learning through PSA and LM

An independent t-test was performed to analyze students attitude towards learning mathematics before learning through PSA and LM

Table 2 : The independent sample t-test of Comparison of students attitude towards learning mathematics before learning through PSA and LM

students attitude of EG and CG before the experiment.					Levene's Test for Equality of Variances		t-test for Equality of Means			
	Mean CG	S.D	Mean EG	S.D	F	Sig.	t	df	Sig. (2-tailed)	M.D
Equal variances assumed	49.17	3.017	49.55	2.669	.505	.479	-0.652	92	.516	-.383
Equal variances not assumed							-0.652	90.651	.516	-.383

M.D= mean difference , S.D = standard deviation

Table 2, displays descriptive and inferential statistics obtained from the summary of students attitude towards learning mathematics before learning through PSA and lecture method. An independent sample t-test was conducted to explore whether there was mean score difference between the two groups. The test revealed no significant difference in the mean scores for CG (Mean = 49.17, S.D= 3.017) and EG (Mean = 49.55, S.D= 2.669) with conditions t(92) = -0.652, p= 0.516 (p = 0.516 > 0.05). The two groups have nearly equal mean scores with slight response variations. So the students

had similar attitude towards learning mathematics before the experiment was conducted. The above result signifies the researcher to intervene on the EG and investigate the effect of teaching mathematics using problem solving approach.

4.2. Effects of Problem Solving Approach on Students Attitude towards Learning Mathematics

Attitude is the individual's beliefs about outcomes or attributes of performing the behavior (behavioral beliefs), weighted by evaluations of those outcomes or attributes. Thus, a person who holds strong beliefs that positively valued outcomes result from performing the behavior would have a positive attitude toward the behavior. Conversely, a person who holds strong beliefs that negatively valued outcomes result from the behavior would have a negative attitude. There are many ways which affects the attitude towards mathematics, such as the teaching method, the support of the structure of the school, the family and the student's attitude towards school (Barton, 2000).

The researcher prepared questionnaire of attitude scale for students towards learning of mathematics . The prepared questionnaire was applied to get information about the effect of the problem solving approach on student's attitude toward learning mathematics . Yusoff and Janor (2014) on their study of the generation of an interval metric scale to measure attitude shows that likert type scale can be used to measure quantitative data on attitude. The literature reviewed shows that learner attitude can be measured using quantitative research approach. Control group was not given the questionnaire because the focus was on the use of problem solving approach and attitude. The questionnaires were contained four types of attitude scales such as confidence, enjoyment, usefulness and engagement as stated in (3.6.2). Each type of attitude category contains four (4) queries where a total of sixteen (16) queries were included in the questionnaire. Eight of the queries were stated using positive statement and the remaining using negative statements.

The response given for the statement of the questionnaire was as follows. The positive responses were given as strongly agree (SA) and agree (A) with numerical value (SA=5) and (A=4). The neutral response was undecided (U) with numerical value (U=3) . The negative responses were disagree (D) and strongly disagree (SD) with numerical values (D=2) and (SD=1). The given negative responses were changed to positive responses with numerical values (D=2) to (A=4) and (SD=1) to (SA=5). The

attitude scale questionnaire was distributed and filled by both experimental and control groups before the instruction of problem solving method to evaluate their attitude towards learning mathematics and distributed and filled with experimental and control group after the instruction of PSA and LM to evaluate the student's attitude towards learning mathematics after learning coordinate geometry using PSA and LM.

Then, the valid responses were analyzed using mean, standard deviation, Paired Samples t-test, and independent t-test of (SPSS. 20.0 of windows) and interpreted.

4.2.1. Analysis of Students Attitude towards Learning Mathematics before Learning through PSA.

Table 3 : Descriptive statistics of the attitude of students towards learning mathematics before learning through PSA .

Statements	N	Mean $\overline{X}$	Std. Deviation
1. Mathematics is a very worthwhile and necessary topic .	47	2.17	.963
2. I have not good results in mathematics achievement	47	4.00	.956
3. I have attended mathematics lesson in the class with interest	47	2.17	.963
4. I am able to do mathematics exercises without too much difficulty	47	2.15	.932
5. I would like to avoid using mathematics outside the school, in college or university or on the job	47	3.85	.834
6. I did not like to solve problems of mathematics .	47	4.06	1.030
7. I have usually enjoyed studying mathematics in the class	47	2.21	.690
8. I have more trouble when doing problems of mathematics	47	3.98	.794
9. I have developed self-confidence when it comes to mathematics class	47	2.06	.942
10. Mathematics has a contributed greatly to science and other fields of knowledge.	47	2.06	.942
11. I would like to develop my mathematics problem solving skills and I try to answer the questions the teacher asks ..	47	2.15	.751
12. I showed failure in solving mathematical problems while reading of the questions.	47	4.23	.840
13. Learning Mathematics did not helps me to develop my mind	47	3.85	.834
14. I checked (tested) my understanding of mathematics by doing exercise and problems	47	2.43	.903
15. I am unable to think clearly while doing and solving any mathematics problems	47	3.89	.914
16. Mathematics is not important in my everyday life.	47	4.02	.897
Valid N (list wise)	47		

As shown in Table 3, the mean scores of negatively stated statements (such as 2,5,6 ,8, 12 ,13,15 and 16) are between 3.85 and 4.23 with slight response variations. The students replied that they have not good results in mathematics achievement ($\overline{X}$ = 4.00 & S.D= 0.956), did not like to solve problems of mathematics($\overline{X}$ = 4.06 & S.D= 1.030), showed failure in solving mathematical problems while

reading of the questions ($\overline{X}$ = 4.23 & S.D= 0.840), did not believe the importance of Mathematics in their everyday life ($\overline{X}$ = 4.02 & S.D= 0.897), they have more trouble when doing problems of mathematics($\overline{X}$ =3.98 & S.D= 0.794), they are unable to think clearly when doing and solving any mathematics problems($\overline{X}$ =3.89 & S.D= 0.914) , they like to avoid using mathematics outside the school, in college or university or in the job($\overline{X}$ =3.85 & S.D= 0.834) and learning Mathematics did not helps them to develop their mind ($\overline{X}$ = 3.85 & S.D= 0.834). These results indicated that students showed their strong agreement for negatively phrased statements as their mean value is greater than or equal to 3.85. This means students had shown high negative attitude (unfavorable attitude) towards learning mathematics as argued by Jamil (2001) and Mohd et al (2011).

For positively phrased statements(for items 1,3,4,7,9,10,11, and 14) the students response revealed lesser mean scores as compared to the negatively phrased statements as shown above. In this regard students indicated that mathematics is a very worthwhile and necessary topic and attended with interest when they learn in the class with ($\overline{X}$ =2.17 & S.D= 0.963). On the other hand students checked (tested) their understanding of mathematics by doing exercise and problems with ($\overline{X}$ =2.43 & S.D= 0.903). They would like to develop their mathematics problem solving skills and they try to answer the questions the teacher asks and able to do mathematics exercises without too much difficulty with ($\overline{X}$ =2.15 & S.D= 0.932). They have usually enjoyed studying mathematics in the class with ($\overline{X}$ =2.21 & S.D= 0.690). They have developed self-confidence when it comes to mathematics class and they responded Mathematics has a contributed greatly to science and other fields of knowledge with the smallest mean score ($\overline{X}$ =2.06 & S.D= 0.942). The above results indicated students had low attitude about the lesson of mathematics which was less than the medium value as described by Mohd et al (2011).

4.2.2. Analysis of Students Attitude towards Learning Mathematics after Learning through PSA

Table 4 : Descriptive statistics of the attitude of students towards learning mathematics after learningthrough PSA

Statements	N	Mean	Std. Deviation
1. Mathematics is a very worthwhile and necessary topic .	47	4.38	.573
2. I have not good results in mathematics achievement	47	1.94	.704
3. I have attended mathematics lesson in the class with interest	47	4.43	.617
4. I am able to do mathematics exercises without too much difficulty	47	4.43	.617
5. I would like to avoid using mathematics outside the school, in college or university or on the job.	47	2.30	.907
6. I did not like to solve problems of mathematics .	47	2.02	.737
7. I have usually enjoyed studying mathematics in the class	47	4.19	.711
8. I have more trouble when doing problems of mathematics	47	2.02	.794
9. I have developed self-confidence when it comes to mathematics class	47	4.28	.615
10. Mathematics has a contributed greatly to science and other fields of knowledge.	47	4.49	.748
11. I would like to develop my mathematics problem solving skills and I try to answer the questions the teacher asks .	47	4.38	.573
12. I showed failure in solving mathematics while reading of the questions	47	1.85	.780
13. Learning Mathematics did not helps me to develop my mind	47	2.02	.794
14. I checked (tested) my understanding of mathematics by doing exercise and problems	47	4.17	.637
15. I am unable to think clearly while doing and solving any mathematics problems.	47	2.15	.780
16. Mathematics is not important in my everyday life.	47	2.00	.933
Valid N (list wise)	47		

As shown in Table 4., the mean scores of negatively stated statementsare between 1.84 and 2.30 with slight response variations. The students replied that they have not good results in mathematics achievement ($\overline{X}$ =1.94& S.D= 0. 704), did not like to solve problems of mathematics .and learning

Mathematics did not helps me to develop my mind($\overline{X}$ =2.02 & S.D= 0.737), showed failure in solving mathematical problems while reading of the questions ($\overline{X}$ =1.85 & S.D= 0.780), did not believe the importance of Mathematics in their everyday life ($\overline{X}$ =2.0 & S.D= 0.933), they have more trouble when doing problems of mathematics ($\overline{X}$ =2.02 & S.D= 0.794), they are unable to think clearly when doing and solving any mathematics problems($\overline{X}$ =2.15 & S.D= 0.780), they like to avoid using mathematics outside the school, in college or university or on the job($\overline{X}$ =2.30 & S.D= 0.907) and mathematics is not important for them in their everyday life with ($\overline{X}$ =2.00 & S.D= 0.933). These results showed that students had rated these negatively phrased statements with low mean scores. Since students reflected their disagreement on these items to the contrary they are confirming their agreement to the opposite of these negatively phrased statements. Therefore, students had favorable attitude towards learning mathematics .

For positively phrased statements the students response revealed higher mean scores as compared to the negatively phrased statements as shown above. In this regard students indicated that mathematics is a very worthwhile and necessary topic, they attended with interest when they learn in the class with ($\overline{X}$ =4.43 & S.D= 0.417). Students usually enjoyed studying mathematics in the class with ($\overline{X}$ =4.19 & S.D= 0.711). They have developed self-confidence when it comes to mathematics class with ($\overline{X}$ =4.28 & S.D= 0.615). They responded Mathematics has a contributed greatly to science and other fields of knowledge with ($\overline{X}$ = 4.49 & S.D = 0.718). They would like to develop their mathematics problem solving skills and they try to answer the questions the teacher asks with ($\overline{X}$ =4.38 & S.D = 0.573). They confirmed learning Mathematics helps to develop a person's mind and they learned to got this with ($\overline{X}$ =4.34 & S.D =0.635). Students indicated that they checked (tested) their understanding of mathematics by doing exercise and problems with ($\overline{X}$ =4.17 & S.D = 0.637). The responses of the above positively stated statements indicated that students had rated the items with high mean score values, which were greater than or equal to 4.17. These indicated experimental group students had high attitude towards learning mathematics after learning coordinate geometry using problem solving approach.

4.2.3. Analysis the Comparison of Attitude of students towards Learning mathematics before and after learning through PSA.

Null hypothesis 1 : There is no significant difference between the attitude of students towards learning mathematics before and after learned PSA.

Table 5: Paired Samples t-test to determine the attitude of students towards Learning mathematics before and after learning through PSA.

Result of attitude of Experimental Group	Mean before	SD	Mean after	SD	Paired Differences Mean	Paired Differences SD	t	df	Sig. value (p- value)
Before and after Using PSA.	49.57	2.627	53.55	2.175	-3.979	3.473	7.853	46	0.000

Table 5, depicts descriptive and inferential statistics obtained from the summary of the results before and after learning through PSA in relation to attitude of students towards learning mathematics . Paired sample t-test was conducted to explore whether there was attitude mean score difference between the mean scores with 0.05 level of significance. The test revealed significant mean score difference before the experiment (Mean = 49.57, S.D= 2.627) and after the experiment (Mean = 53.55, S.D= 2.175) with conditions t(46) = -7.853, p= 0.000 , which is significant at 5% significant level and p =0 .000< 0.05. It concluded that the attitude scores before and after the experiment of the two groups are significantly different and hence the null hypothesis 1 is rejected. If the result of the test is significant ($p<0.05$), the assumption is violated (Howell, 2012; Cardinal and Aitken, 2013; Field, 2013), So there is a significant mean difference between experimental and control group students in attitude towards learning mathematics in particular coordinate geometry. Moreover, students learned by PSA had more favorable attitude towards learning mathematics than students learned by lecture method . The PSA group attitudes towards Mathematics particularly in coordinate geometry levels

were increased and were significantly higher than the lecture method. This indicates that using the PSA strategy is likely to be better than using lecture teaching methods in attitudes towards learning Mathematics (coordinate geometry) for preparatory and secondary school students . However, it seems that PSA is likely to raise students' confidence more than lecture teaching methods. From the results obtained, the intervention groups were made more effort in learning coordinate geometry as compared to the comparison group .This result is supported by the study of a more recent study in a college setting also shows a positive change in students' attitudes towards mathematics as a result of an intervention (Hodges & Kim, 2013). Research studies also show that when students perceive the learning environment as supportive and positive in general, they are more likely to develop positive attitudes (Monteiro, &Peixoto, 2012) .

4.2.4. Analysis the Comparison of Attitude of students towards learned mathematics through PSA and LM.

Null hypothesis 2: There is no significant difference between the attitude of students towards learning mathematics **by** PSA and lecture method**.**

An independent t-test was performed to analyze differences of students attitude towards learning mathematics by PSA and LM.

Table 6 : An independent sample t-test to analysis theattitude of students towards learning mathematics b**y** PSA and LM**.**

post- attitude results of CG and EG.					Levene's Test for Equality of Variances		t-test for Equality of Means			
	Mean CG	S.D	Mean EG	S.D	F	Sig.	t	df	Sig. (2-tailed)	M.D
Equal variances assumed	49.28	2.818	53.60	2.102	5.788	.018	-8.421	92	.000	-4.319
Equal variances not assumed							-8.421	85.089	.000	-4.319

M.D= mean difference , S.D = standard deviation

Table 6, displays descriptive and inferential statistics obtained from the summary of the students learned by PSA and LM responses concerning post-attitude towards learning mathematics. An independent sample t-test was conducted to explore whether there was mean score difference between the two groups. The test revealed significant mean difference in the mean scores for CG (Mean = 49.28, S.D= 2.818) and EG (Mean = 53.60, S.D= 2.102) with conditions t(92) = -8.421, p= 0.000 (p = 0.000<0.05), which is strongly significant. Hence the null hypothesis was rejected, so from the results of independent sample t-test showed significant mean difference of students attitude towards learning mathematics by PSA and lecture method.. The mean difference observed was due to the experimental group who received a problem-solving approach intervention registered some significant changes towards learning mathematics . This finding support the possibility of a problem-solving approach to positively change student's attitude towards learning mathematics . This was supported by Guillory, 2014 generally, teaching through problem solving approach does not only impact the development of students' higher-order thinking skills but also reinforce positive attitudes.

4.3. Analysis of the Academic Achievement Score of Students before Learned through PSA and LM

The academic achievement score of the sample students in the pretest were analyzed and interpreted. The students were given the pretest (Appendix C) before the experiment was conducted. The result of the pretest was arranged in decreasing order and systematic labeling of the students was done into two groups. This was chosen intentionally to get a group with equivalent mean score and standard deviation .The group labeling was in a conjugate manner from 1 to 2 and 2 to 1 as shown in (Appendix I).

Table 7: Mean score and standard deviation of the pretest result

No.	Group	Mean	No. of students	Std. Deviation
1	Group 1	8.36	47	3.17
2	Group 2	8.32	47	3.20
Total sample Group		8.34	94	3.22

The pretest was given for grade 11 male 53 and female 41 totally 94 students of HGPSS. As seen from the above table 7, group 1 has mean =8.36, standard deviation= 3.17 and group 2 has mean =8.32, standard deviation =3.2 and the systematically formed groups have approximately equivalent mean and standard deviation. Independent samples t-test was used to know whether there was a significant difference between experimental and control group of pretest achievement. The independent t-test (Table 8) below showed that pretest score had a t value of -0.814 with 92 degree of freedom and significant value (p-value) of 0.418, which was clearly not significant since $p = 0.418 > 0.05$, so students had equivalent mathematics result and had similar mathematics background before the experimentconducted. The independent samples t-test analysis for pretest mathematics achievement for both groups indicated no significant differences in academic achievement at both groups before the intervention. This shows that the groups were equivalent in their mathematics academic achievement and had similar mathematics knowledge. This result supported by Kousar (2010). Depending on this result group 2 assigned as experimental group and group 1 assigned as control group using randomly (lottery method).

Table 8: An independent samples t-test to determine mean difference of per-test between students learned by PSA and LM .

per-test between (CG) and (EG) .					Levene's Test for Equality of Variances		t-test for Equality of Means			
	Mean CG	S.D	Mean EG	S.D	F	Sig.	t	df	Sig. (2-tailed)	M.D
Equal variances assumed	55.7	21.13	55.4	21.3	.213	.646	-.814	92	.418	-3.553
Equal variances not assumed							-.814	91.475	.418	-3.553

M.D mean difference , S.D standard deviation significant at 0.05 level (two-tailed)

4.4. Effects of PSA on Students Academic Achievement in mathematics after learned through PSA and LM

❖ Analysis of Academic Achievement of students in mathematics after learned through PSA and LM

Null hypothesis 3: There is no significant difference between academic achievement of students in mathematics after learned by PSA and lecture method

A post test was administered at the end of the experiment. The test was contained 20 questions on the topic of coordinate geometry. A self developed post-test was administered to the experimental and control groups. To observe the effects of the experiment on student's academic achievement the post test result was analyzed using independent samples t-test. An independent t-test was performed to analyze difference of academic achievement in coordinate geometry of experimental and control groups. The results were shown in Table 9 below.

Table 9 : Analysis of the Independent samplest-test of Students Academic Achievement in mathematics after learned by PSA and LM

post-test results of EG and CG					Levene's Test for Equality of Variances		t-test for Equality of Means			
	Mean CG	S.D	Mean EG	S.D	F	Sig.	t	df	Sig. (2-tailed)	M.D
Equal variances assumed	44.15	15.891	66.83	15.344	.035	.852	-7.039	92	.000	-22.681
Equal variances not assumed							-7.039	91.888	.000	-22.681

M.D mean difference , S.D standard deviation significant at 0.05 level (two-tailed)

Table 9 , showed descriptive and inferential statistics obtained from the summary of the the students learned by PSA and lecture method responses concerning post-test results in coordinate geometry. An independent sample t-test was conducted to explore whether there was mean score difference between the two groups. The test revealed significant mean difference in the mean scores for CG (Mean = 44.15, S.D= 15.891) and EG (Mean = 66.83, S.D= 15.344) with conditions t(92) = --7.039, p= 0.000 ($p = 0.000 < 0.05$), which was strongly significant. Hence the hypothesis was rejected, So there was a significant mean difference between EG and CG of post test achievement score in coordinate geometry. This result implied the experimental group sample students showed a better academic achievement in coordinate geometry than the control group sample students. The PSA has evidently provided the experimental group with an effective method of learning. The PSA in teaching enabled the experimental group to achieve a higher rate of mastery of the relevant concepts and skills integrated in the lessons in coordinate geometry.

This result was observed due to the students who received a problem-solving approach intervention registered some significant changes towards learning mathematics in coordinate geometry. This result supported by Masingila & Raymond (2011), accordingly, the ultimate goal of a problem-solving approach in teaching mathematics is to enable learners to develop understanding of concepts in mathematics, and there by improve their academic achievement in mathematics. Teaching through problem-solving has become a major focus in mathematics education as it helps students develop mathematical knowledge. Chang etal (2001) that students showed good results if they were taught with the problem-solving approach. Also supported by Kousar (2010), indicated that the experimental group out scored the control group significantly on the assessment following the intervention.

4.5. Analysis of the Comparison of Academic Achievement of students in mathematics (Coordinate Geometry) before and after learning through PSA

Null hypothesis 4: There is no significant mean difference in academic achievement of students in mathematics (Coordinate Geometry) before and after learning through PSA

Table 10 : The Paired Samples t-test of Comparison of academic achievement of students in mathematics (Coordinate Geometry) before and after learning through PSA.

Result of Experimental Group	Mean before	S.D	Mean after	S.D	Paired Differences		t	df	Sig. value (p- value)
					Mean	Std. Deviation			
Before and after Using PSA.	55.47	21.354	66.06	16.317	10.596	11.813	-6.149	46	0.000

The Comparison of academic achievement in mathematics, particularly in coordinate Geometry of students learned by PSA were used to determine whether there was a significance difference between the pretest and post test scores of students which was taught by using PSA. From descriptive and inferential statistics (Table 10) above, the pretest mean score of experimental group (mean =55.47 and standard deviation = 21.354) and post-test mean score of experimental group (mean = 66.06 and standard deviation = 16.317). This indicated that the post-test score of students learned through PSA was much greater than the pretest score of students learned through PSA .

In addition to this , Statistical analysis of the paired samples t-test in (Table 10) above observed that the academic achievement test scores of students learned through before and after PSA had a t value of -6.149 with 46 degree of freedom and p-value of .000, which is significant at 5% significant leveland $p = 0.000 < 0.05$ and hence the null hypothesis 5 is rejected. So there is a significant mean difference between students learned through before and after PSA in coordinate geometry. This shows that the differences from pretest to post-test for intervention group were statistically significant for academic achievement. This means instruction with the PSA has a significant impact in improving student's academic achievement in coordinate geometry than the control group which was taught with lecture method . From the results obtained, the intervention group was made more positive effect in academic achievement of coordinate geometry. The researcher concluded that the PSA had a good

effect on student's academic achievement in coordinate geometry as measured by post-test. The students who received a PSA intervention registered significant changes. This result was supported by most recent studies (Bayaga and Wadesango, 2014) pointed out that students having positive attitude achieved better in achievement.

4.6. Analysis of the Comparison of Academic Achievement in mathematics (Coordinate geometry) before and after learning through lecture method

Null hypothesis 5: There is no significant mean difference in academic achievement in mathematics (coordinate geometry) before and after learning through LM

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Table 11: The paired t-test comparison of academic achievement in mathematics (coordinate geometry) before and after learning through LM.

Result of Control Group (CG)					Paired Differences		t	df	Sig. value (p- value)
	Mean before	S.D	Mean after	S.D	Mean	Std. Deviation			
Before and after Using Traditional Method.	55.72	21.949	47.87	14.512	7.851	14.245	3.779	46	0.000

The comparison of academic achievement in mathematics (coordinate geometry) before and after learning through LM were used to determine whether there was a significance difference between the pretest and post test scores of students which was taught by LM

From paired samples statistics (Table 11) above, the pretest mean score of CG (mean =55.72 and standard deviation = 21.949) and post-test mean score of CG (mean =47.87 and standard deviation =14.512). The academic achievement mean score of CG before using LM was greater than that of the control group after using the method . The pretest and post test scores of CG had a t value of 3.779

with 46 degree of freedom and significant (2-tailed) value of 0 .000, which is significant at 5% significant level and $p = 0.000 < 0.05$. It can be concluded that the achievement mean score of CG before and after using LM was significantly different and hence the null hypothesis is rejected. So there is a significant mean difference between pretest and post test test scores of control group students in coordinate geometry. Significant mean difference between pretest and post test test scores of control group sample students was observed.

It indicated that post-test score of control group was lesser. This may have been caused by the lack of relevant teaching intervention introduced to the group. The respondents of the control group were taught using the LM of teaching mathematics where the students serve as receiver of information. The control group was not given opportunities for exploration, interaction, and collaboration. The learning environment of the control group was dominated by the teacher. This was probably resulted from negative attitude of students for the lesson of coordinate geometry, their taught of mathematics of coordinate geometry to be difficult and boring. This result was supported by the study of Monterio & Peixoto (2012), negative attitudes are the results of frequent and repeated failures when dealing with mathematical tasks.

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5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

- The main purpose of this study was to investigate the effects of PSA on students' academic achievement and attitude towards learning mathematics (coordinate geometry). Specifically, to evaluate the effect of the PSA on students attitude towards learning mathematics, investigate the effects of the PSA on student's academic achievement in mathematics, particularly in coordinate geometry after learning through PSA and LM, identify whether there was a significant difference between the academic achievement of students in coordinate geometry learned before or after through PSA and identify whether there was a significant difference between the academic achievement of students before and after learning through LM and also analyzed in order to attain the desired objectives of the basic research questions raised so far:

  - ✓ What is the effect of the PSA on student's attitude towards learning mathematics ?
  - ✓ What is the effects of the PSA on student's academic achievement in mathematics , particularly in coordinate geometry after learning through PSA and LM ?
  - ✓ Is there a significant difference between the academic achievement of students in coordinate geometry learned before or after through PSA?
  - ✓ Is there a significant difference between the academic achievement of students in coordinate geometry learned before or after through LM ?

For this purpose, from grade 11 section A, B and C students of HGPSS 94 students were selected. A pretest containing per-requisite knowledge that were helped the students to learned coordinate geometry was administered before the experiment was conducted. The result of the pretest was arranged in decreasing order and systematic labeling of the students was done into two groups. This was chosen intentionally to get a group with equivalent mean score. The group labeling was in a conjugate manner from 1 to 2 and 2 to 1. The groups were randomly assigned as EG and CG . The coordinate geometry topic was instructed in a lecture way for control group and used problem solving approach for experimental group. Experimental research method and The pretest-post-test experimental design was used when participants were studied before and after the experimental manipulation. Questionnaire and pretest and post test were used as data collecting instruments to

obtained data from the samples. The collected data were systematically organized and analyzed quantitatively using mean, standard deviation and, the independent t-test and paired t-test.

Depending on the results of the analysis the following major findings have been obtained:

The effect of the PSA on student's attitude towards learning mathematics

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The study specifically investigated the effects of PSA on students attitude towards learning mathematics . The analysis of the questionnaire administered for the students indicated that the two groups have nearly equal mean scores with slight response variations. So the students had similar attitude towards learning mathematics before the experiment was conducted and after the experiment the students learned by PSA had more favorable (positive) attitude towards learning mathematics (coordinate geometry) than the control group. The experimental group who received a PSA intervention registered some significant changes towards learning mathematics . This finding support the possibility of a PSA to positively change student's attitude towards learning mathematics. From the results obtained, the students learned by PSA were made more effort in learning mathematics as compared to the students learned by LM

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The effect of the PSA on student's Academic Achievement in mathematics (coordinate geometry) after learning through PSA.

On assessment of sample students before the experiment conducted indicated that there was no significant differences in achievement at two groups . This shows that the groups were equivalent in their previous mathematics knowledge (coordinate geometry) and background. After the experiment, the result of the post-test indicated that there was a significant mean difference in their achievement. The students learned by PSA showed a better mathematics achievement in coordinate geometry than the students learned by LM . The EG who received a PSA intervention registered significant changes. The problem solving approach in teaching enabled the experimental group to achieve a higher rate of mastery of the relevant concepts and skills integrated in the lessons in coordinate geometry. This result supported by Masingila& Raymond (2011), accordingly, the ultimate goal of a problem-solving approach in teaching mathematics is to enable learners to develop understanding of concepts in mathematics, and there by improve their academic achievement in mathematics.

Is there a significant difference between the academic achievement of students in mathematics (coordinate geometry) before or after learned through PSA?

The researcher used Paired Samples t-test for the Comparison of academic achievement of students learned before and after through PSA . The post-test score of EG after the treatment was much greater than the pretest score of EG. The instruction with the PSA has a significant impact in improving student's mathematics achievement in coordinate geometry. The problem solving approach had a good effect on student's academic achievement in coordinate geometry as measured by post-test. The experimental group who received a PSA intervention registered significant changes. This result was supported by most recent studies (Bayaga and Wadesango, 2014) pointed out that students having positive attitude achieved better in achievement.

Is there a significant difference between the academic achievement of students in coordinate geometry before or after learnedthrough LM ?

The pretest and post test scores of the students in the CG which was taught by using LM. There was a significant mean difference between pretest and post test scores of CG in coordinate geometry. The pretest mean score of CG was greater than that of post-test score of CG. The learning environment of the control group was dominated by the teacher. This was probably resulted from negative attitude of students for the lesson of coordinate geometry, their taught of mathematics of coordinate geometry to be difficult and boring. This result was supported by the study of Monterio & Peixoto (2012), negative attitudes are the results of frequent and repeated failures when dealing with mathematical tasks.

5.2. Conclusions

The main objective of this study was to investigate the effects of the problem-solving approach on students' academic achievement and attitude towards learning mathematics.

Depending on the statistical analysis and finding of the study the following conclusions were formed.

At the beginning, the attitude of students between the two groups were not significantly different at the 5% level of significance before the experiment as observed from the independent t-test analysis. The PSA develops a positive effect on students attitude towards learning mathematics in coordinate geometry as compared to the lecture method of teaching.

This was supported by Guillory, 2014 generally; teaching through problem solving approach does not only impact the development of students' higher-order thinking skills but also reinforce positive attitudes. A more recent study in a college setting also shows a positive change in students' attitudes towards mathematics as a result of an intervention (Hodges & Kim, 2013).

Both the students learned by PSA and LM had similar academic achievement towards learning mathematics (coordinate geometry) before the experiment was conducted as observed from the independent t-test analysis. The problem solving approach in teaching enabled the students learned through PSA to achieve a higher rate of mastery of the relevant concepts and skills integrated in the lessons in coordinate geometry. The problem solving approach provides a better academic achievement in coordinate geometry than the students learned by LM. This result supported by Masingila& Raymond (2011), accordingly, the ultimate goal of a problem-solving approach in teaching mathematics was to enable learners to develop understanding of concepts in mathematics, and there by improve their academic achievement in mathematics.

A problem-solving approach if effectively implemented has the potential of making learners perform better on academic achievement in coordinate geometry as compared from LM of teaching as observed from the experiment..

Lecture method of teaching of mathematics in coordinate geometry did not improve students mathematics achievement as problem-solving approach. In HGPSS grade 11 coordinate geometry lesson was taught for some year mostly using lecture method of teaching and students had negative attitude and had got low achievement. So, traditional method of teaching was inappropriate method for mathematics (coordinate geometry). Conversely, PSA was an appropriate method to develop more understand in the lesson of coordinate geometry and improve their academic achievement of mathematics (coordinate geometry).

In general, from the result in the study, the instruction with PSA had a positive effect on student's attitude towards learning mathematics , on students understanding of coordinate geometry and on student's academic achievement in coordinate geometry as compared from the lecture method of teaching as observed from the experiment.

5.3. Recommendations

From the result obtained and conclusions made the researcher would like to forward the following recommendations:

- This study proved that problem solving is more effective method of instruction for teaching and learning mathematics,particularly for coordinate geometry as compared to lecture method of teaching. Therefore Mathematics teachers should use PSA of instruction to develop a positive attitude on students towards learning mathematics (coordinate geometry) instead of teaching using LM.

- Mathematics teachers should use PSA in the teaching and learning process to improve the academic achievement of students in mathematics (coordinate geometry) than using LM.

- Regular extensive training program, seminars, workshops and other constructive training opportunities should be organized for mathematics teachers in preparatory schools: to give them knowledge and understanding of PSA, on how to implement PSA in mathematics classrooms effectively, on how to develop a positive attitude on students towards learning mathematics, on how to improve students mathematics achievement.

- Mathematics teachers need to create problem solving interest among their students and be sure that every student is engaged in problem solving process during class room instruction.

- The study was conducted only to investigate the effect of PSA on student's attitude towards learning mathematics and academic achievement in mathematics (coordinate geometry) of grade 11. The researcher recommends that it should be conduct on other geometry part and other fields of mathematics in all grade levels of preparatory school students.

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APPENDICES

AppendixA: Students Attitude Scale Questionnaire

HARAMAYA UNIVERSTITY

POSTGRADUATE PROGRAM DIRECTORATE

COLLAGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF MATHEMATICS

Dear students,

The purpose of this questionnaire is to collect ample information about grade 11 students attitude towards learning coordinate geometry. The information to be obtained through the questionnaire is going to be used only for an M.Ed thesis undertaking and your genuine response are highly valuable .Therefore, the failure and success of this study depends on your response .Hence, please fill in the questionnaires honestly. Thank you in advance for your cooperation!

Direction: This questionnaire consists of statements about your attitude towards learning coordinate geometry. There are no correct or incorrect responses. Read each item carefully. Please think about how you feel each item .Based on the Likert scale symbolized as strongly agree (SA), agree (A), undecided (U), disagree (D), and strongly disagree (SD). Tick (√) the code that most closely corresponds to how each statement best describes your feeling. If you make a mistake, cross by putting (X) through the tick [√] and then tick in the appropriate box in the table below. Please answer every question. You are not required to write your name.

PLEASE USE THESE RESPONSE CODES FOR THE FOLLOWING QUESTIONS

5- Strongly Agree (SA)

4- Agree (A) 2- Disagree (D)

3- Undecided (U) 1- Strongly Disagree (SD)

No.	Attitude scale questionnaire of learning coordinate geometry	Response Codes				
		SA	A	U	D	SD
1	Mathematics is a very worthwhile and necessary subject .					
2	I have **no** good results in mathematicsachievement .					
3	I have attended mathematics lesson in the class with interest.					
4	I am able to do mathematics exercises without too much difficulty.					
5	I would like to avoid using mathematics outside the school, in college or university or on the job.					
6	I did **not** like to solve problems of mathematics .					
7	I have usually enjoyed studyingmathematicsin the class					
8	I have more trouble when doing problems of mathematics.					
9	I have developed self-confidence when it comes to mathematics class.					
10	Mathematics has a contributed greatly to science and other fields of knowledge.					
11	I would like to develop my mathematics problem solving skills and I try to answer the questions the teacher asks .					
12	I showed failure in solving mathematical problems while reading of the questions.					
13	Learning Mathematics did not helps me to develop mymind .					
14	I checked (tested) my understanding of mathematics by doing exercise and problems.					
15	I am unable to think clearly when doing and solving any mathematics problems.					
16	Mathematics is **not** important in my everyday life .					

Appendix B: Students Attitude Scale Questionnaire (Amharic version)

ሐረማያዩኒቨርስቲ

የድህረምረቃፕሮግራምዳይሬክቶሬት

የተፈጥሮናኮምፒውትሽናልሳይንስኮሌጅ

የሂሳብትምህርትክፍል

የዚህመጠይቅዓላማየ 11ክፍልተማሪዎችኮአርድኔትጅኦሜትሪን የመማርፍላጎትላይያላቸውን ሁኔታመረጃለመሰብሰብነው። ከዚህመጠይቅየሚሰበሰበውመረጃየሚያገለግለውለሁለ**ተኛዲግሪማማያለሚደረግጥናትሲሆንጥናቱንበአግባቡለማጠናቀቅየእናንተእውነተኛምላሽናቀናትብብርበእጅጉያስፈልጋል።**

መመሪያ፡

ይህመጠይቅስለእናንተኮአርድኔትጅኦሜትሪለመማርያላችሁን ፍላጎትየሀሳብመግለጫወረፍተነገሮችየያዘነው። ስለሆነምትክክለኛወይምየተሳሳተምላሽየሚባልአይኖርም። ስለዚህከዚህበታችየተዘረዘሩትንጥያቄዎችበጥንቃቄካነበብሽ/ህበኃላየእኔንአመለካከትወይምፍላጎትይወክላልየምትይውን/ለውን ከጎንበሚገኘውክፍትሳጥን ውስጥይህን **ምልክትበማስቀመጥበሁሉምጥያቄዎችምላሽሽን**/ህንስጪጥ። ስምሽን/ህንመፃ ፍአስፈላጊአይደለም። በሰንጠረዡውስጥየተቀመጡትምርጫዎችየሚወክሉትየሚከተሉትንይሆናል፡፡

SA-በጣምእስማማለሁ **A-**እስማማለሁ **U**-መወሰንያቅተኛል

D- አልስማማም **SD**- በጭራሽአልስማማም

ተ.ቁ.	መጠይቅ	ምላሽ				
		SA	A	U	D	SD
1	ሂሳብ በጣም ጠቃሚና አስፈላጊ የትምህርት ዘርፍነው።					
2	በሂሳብ ትምህርት ምዘና ጥሩ ውጤት አላመጣም።					
3	የሂሳብትምህርትንበክፍልውስጥበፍላጎትእከታለላለሁ ።					
4	የሂሳብ መልመጃዎችን፣ጥያቄዎችን ብዙም ሳልቸገር መስራት እችላለሁ።					
5	የሂሳብ ትምህርትን ከትምህርት ቤት ውጭ፤ኮሌጅ ወይም ዩኒቨርስቲ እንዲሁም በስራ ቦታ እንዳልጠቀም አደርጋለሁ።					
6	የሂሳብ ትምህርት ፕሮብሌሞችን፤ ጥያቄዎችንመስራት(solve) ማድረግ አልወድም።					
7	የሂሳብ ትምህርትን በክፍል ውስጥ ስማር በአብዝሀኛው ደስ እያለኝ ነው ።					
8	የሂሳብ መልመጃዎችን፣ጥያቄዎችን ስሰራ በጣም እቸገራለሁ::					
9	የሂሳብ ትምህርትን ለመማር ወደ ክፍል ስመጣ በራስ መተማመኔ ይጨምራል ።					
10	ሂሳብ ለሳይንስና ለሌላ የእውቀት ዘርፍ ትልቅ አስተዋጽዎ አለው ።					
11	የሂሳብ ጥያቄዎችን የመስራት ክህሎቴን ማሻሽል እፈልጋለሁ ለዚህም መምህር የሚሰጠኝን ጥያቄዎች ለመስራት ጥረት አደርጋለሁ።					
12	የሂሳብ መልመጃዎችን፣ጥያቄዎችን ለመስራት ገና ማንበብ ስጀምር ፍላጎቴና ተነሳሽነቴ ዝቅይላል።					
13	ሂሳብ መማር የእኔን አስተሳሰብ ከማሳደግ ፣ ከማስፋት አኳያ የሚጠቅመኝ ነገር የለም ።					
14	የሂሳብትምህርትጽንስሀሳብንመረዳቴንጥያቄዎችንናመልመጃዎችንበመስራትአረጋግጣለሁ።					
15	ማንኛውንም የሂሳብ ፕሮብሌሞችን (ጥያቄዎችን) ስሰራናሶልቭ (solve) ሳደርግበግልጽአስቤናተጠንቅቄሳይሆንእንደዋዛነውየምሰራው።					
16	ሂሳብ ትምህርት መማር ለእኔ የእለት ተእለት ህይወት የሚጠቅመኝ ነገር የለም።					

Appendix C: pretest Questions for students

HARAMAYA UNIVERSTITY

POSTGRADUATE PROGRAM DIRECTORATE

COLLAGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF MATHEMATICS

Pretest questions: for selected grade 11 students of Hotie General and Higher Education Preparatory Secondary School

Direction: solve each of the following questions and choose the best answer to the problem from the given alternative.

1. One of the following is the distance between the points A (6, 1) and B (1,-2)?

   A. 6 B. $\sqrt{34}$ C. -4 D. 1

2. If the coordinates of the end points of a line segment are (-3, 1) and (5,7) ,then the mid-point is

   A. (4,4) B. (-1, 4) C. (1, 4) D. (-4,3)

3. What is the gradient (slope) of the line passing through the points A (-5,-2) and B (7,-8)?

   A. $\frac{-1}{2}$ B. $\frac{-5}{6}$ C. -3 D. $\frac{3}{4}$

4. Let R (-2, 4) and T (5, 1) be points on the coordinate plane, then which of the following is true about point R and T.

   A. The distance between points R and T is $\sqrt{58}$

   B. The equation of the line is y=-2x-3

   C. The line through R and T is vertical

   D. The mid-point of the line RT is $(\frac{-3}{2},\frac{5}{2})$

5. Find the angle of inclination of the line if its slope is $\frac{1}{\sqrt{3}}$?

   A. 30° B. 60° C. 150° D. 120°

6. Which oneofthe followingpointlie on the line y=-5x+4?

   A. (-2,14) B. (-1,-9) C. (2,6) D. (-3,-19)

7. What are the slope and y- intercept respectively , if the equation of the line is

   3(y-2x) = y +$\frac{1}{2}$ (1- 2x)?

   A. $\frac{5}{2}$, $\frac{1}{4}$ B. $\frac{5}{2}$, -$\frac{1}{4}$ C. $\frac{-7}{4}$, $\frac{1}{8}$D.$\frac{7}{4}$,- $\frac{1}{8}$

8. Suppose L1passes through P (-1, -3) and Q (2, 6). Find the slope M2 of any line L2 that is perpendicular to L1?

   A. 3 B. -3 C. $\frac{-1}{3}$ D. $\frac{1}{3}$

9. Determine K sothat the line with equation 4x+Ky =12 will be parallel to the line with equation x=3y.

   A. 12 B. -12 C. 10 D. -10

10. Which one of the following is the equation of the line which passes through the points P (-4,-2) and Q(6, 3)?

    A. Y = $\frac{-1}{2}$x B. y = 2x C. y = -2x D. y = $\frac{1}{2}x$

11. P (3,5) and Q (1,-3) are two opposite vertices of a square . Find its area?

    A. 32 B. $\sqrt{68}$ C. 34 D. $\frac{\sqrt{68}}{2}$

12. Find the coordinate of the point R that divides the line segment with end-points A (6, 2) and B (1,-4) in the ratio 2:3.

    A. $(4,\frac{-2}{5})$ B. $(4, \frac{2}{5})$ C. (-4, -2) D. $(-1, \frac{3}{5})$

13. Which one of the following points is in the third quadrant?

    A. (4, -6) B. (-5, -9) C. (0, -2) D. (-5 , 0)

14. The midpoint of a line segment is M (-3, 2) .One end point of the segment is P (1,-3). What is the coordinate of the other end-point?

A. (-5,1)B. (7,-7) C. (-7,7) D. (5,-1)

15. What is the equation of the line passing through the point P and parallel to the line Lfor L: 2x-5y-4=0 ; P(-1,2).

    A. 2x-3y-12=0 C. 2y+5x-9 =0

    B. 5y-2x+12 =0 D. 2x-5y+12=0

Appendix D: Pretest result of experimental and control groups (all sample students)

No.	Pretest result	No.	Pretest result	No.	Pretest result	No.	Pretest result	No.	Pretest result
1	13	20	6	39	14	58	2	77	15

2	10	21	8	40	10	59	11	78	4
3	7	22	6	41	9	60	8	79	13
4	11	23	4	42	9	61	6	80	6
5	3	24	9	43	7	62	6	81	12
6	6	25	5	44	5	63	5	82	8
7	9	26	6	45	4	64	15	83	9
8	12	27	8	46	7	65	8	84	11
9	9	28	6	47	13	66	10	85	9
10	10	29	3	48	4	67	12	86	8
11	11	30	14	49	3	68	4	87	10
12	7	31	8	50	14	69	3	88	4
13	12	32	9	51	7	70	12	89	13
14	7	33	9	52	12	71	7	90	10
15	8	34	5	53	8	72	6	91	8
16	5	35	11	54	9	73	11	92	11
17	13	36	7	55	6	74	3	93	8
18	11	37	2	56	10	75	9	94	9
19	7	38	10	57	11	76	12		

Appendix E: post-test Questions for students

HARAMAYA UNIVERSTITY

POSTGRADUATE PROGRAM DIRECTORATE

COLLAGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTMENT OF MATHEMATICS

Posttest:for selected grade 11 students of Hotie General and Higher Education Preparatory Secondary School

Direction: solve each of the following questions and choose the best answer to the problem from the given alternative.

1. If the angle of inclination of a line is 120°, the its slope is :

   A. $-\sqrt{2}$ B. $-\sqrt{3}$ C. 1 D. $\frac{\sqrt{3}}{2}$

2. Which one of the following is the equation of the line that passes through (2,-3) and is parallel to the line with equation y = 4x-5?

   A. y = 4x-11 B. y = $\frac{-1x}{4}\frac{-5}{2}$ C. y = 4x+1 D. y = -2x+4

3. What is the tangent of the angle between the lines L1: 3x-y-2=0;L2: 4x-y-6=0?

   A. $\frac{2}{3}$ B. $\frac{1}{13}$ C. 7 D. 5

4. What is the distance from the point P (-2.4) to the line with equation 4y = 3x-1?

   A. 13 B. 5 C. $\frac{23}{5}$ D. 12

5. What are the values for the center (c) and radius (r) of the circle x^2+y^2 -8x +12y -12 = 0?

   A. c = (4,6) , r = 4 B.c = (4,-6) ,r= 8 C. c = (2,6) , r = 12 D. c = (-2,6) , r = 6

6. Which one of the following is the equation of the circle with center at (2 ,5) and the line with equation 2x-y = 1 is a tangent line to the circle ?

   A. $(x-2)^2 + (y-5)^2 = 2\frac{\sqrt{5}}{5}$ C. $(x+2)^2+ (y+5)^2 = \frac{4}{5}$

   B. $(x-2)^2 + (y-5)^2 = \frac{4}{5}$ D. $(x+2)^2+ (y+5)^2 = 2\frac{\sqrt{5}}{5}$

7. What is the intersection of the circle with equation $(x-1)^2 + (y+1)^2 = 25$ and the line 4x -3y = 7?

   A. (-2, 5) B. (4, -5) C. (-2,-5) and (4, 3) D. (4, 3)

8. Suppose the eccentricity of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ is a reciprocal to that of the eccentricity of the ellipse $x2+4y^2 = 4$. If thehyperbola passes through a focus of the ellipse, then what is the equation of the hyperbola?

   A. $x^2 - 2y^2 = 2$ C. $\frac{x^2}{3} - \frac{y^2}{2} = 1$

   B. $x^2 - 3y^2 = 3$ D. $\frac{x^2}{2} - \frac{y^2}{3} = 1$

9. The equation of the line that passes through (2,-1) and is perpendicular to 3x + 4y = 6 is :

A. -4x +3y =5 C. 4x +3y = 11

B. 4x - 3y = 5 D. -4x + 3y = -11

10. What is the equation of the line tangent to the circle with equation $x^2 + y^2 = 45$ at the point P (9,-8)?

A. $y = \frac{9x}{8}$ B. $y = \frac{8x}{9} - \frac{145}{8}$ C. $y = \frac{9x}{8} - \frac{145}{8}$ D. $y = \frac{9x}{8} + \frac{145}{8}$

11. Find the equation of the ellipse with center at (1,4) and vertices at (10,4) and (1,2) ?

A. $\frac{(x-1)^2}{81} + \frac{(y-4)^2}{4} = 1$ C. $\frac{(x-1)^2}{81} + \frac{y^2}{4} = 1$

B. $\frac{(x-1)^2}{9} + \frac{(y-4)^2}{2} = 1$ D. $\frac{x^2}{9} + \frac{y^2}{2} = 1$

12. Find the equation of a hyperbola , if the foci are F(6,5) and (-4,5) and transverse axis is 6 units long? A. $\frac{(x-1)^2}{9} - \frac{(y-5)^2}{91} = 1$ C. $\frac{(y-5)^2}{91} - \frac{(x-1)^2}{9} = 1$

B. $\frac{(x+1)^2}{9} + \frac{(y+5)^2}{91} = 1$ D. $\frac{(x+1)^2}{9} - \frac{(y-5)^2}{91} = 1$

13. Which one of the following is **not** true about the equation of an ellipse $4x^2 + y^2 = 8$?

A. The center is C (0, 0) C. Length of semi-major axis is $2\sqrt{2}$

B. The foci are F $(0, \pm\sqrt{6})$ D. Length of semi-minor axis is 2

14. Find the length of the latus rectum of the parabola $y^2 - 6y + 8x + 25$?

A. 16 B. 6 C. 4 D. 8

15. Find the equation of the parabola with vertexV (4, 6) and focus (-8, 6)?

A. $(y-6)^2 = -16 (x-4)$ C. $(y-6)^2 = 16 (x-4)$

C. $(y-6)^2 = -48 (x-4)$ D. $(y-6)^2 = 48 (x-4)$

16. Which one of the following is true about an equation of the ellipse $\frac{(x-2)^2}{9} + \frac{(y-1)^2}{1} = 1$?

A. Length of major axis is 3 C. The eccentricity of the ellipse is $\frac{2}{3}$

B. Foci are (2+2$\sqrt{2}$, 1) D. Vertices are (-1, 1) and (5, 1)

17. Which one of the following is **not** true about the parabola 4y2= -12x?

A. Equation of directrix is x= $\frac{-3}{4}$ C. The focus of the parabola is F($\frac{-3}{4}$,0)

B. Length of latus rectum is 9 D. xs- axis is an axis of symmetry

18. Find the equation of parabola the vertex is at (1,2) , the axis is parallel to the x-axis and the Parabola passes through (6, 3)?

A. $(y-2)^2 = \frac{1}{5}(x-1)$ C. $(y-2)^2 = \frac{-1}{5}(x-1)$

B. $(y-2)^2 = \frac{-1}{5}(x+1)$ D. $(y-2)^2$ 5(x-1)

19. Find the equation of the hyperbola the transverse axis coincides with the x-axis, centre at C (3, 0); length of transverse and conjugate axes equal to 8 and 6,respectively?

A. $\frac{(x-3)^2}{16} - \frac{y^2}{9} = 1$ C. $\frac{y^2}{9} - \frac{(x-3)^2}{16} = 1$

B. $\frac{(x-3)^2}{16} + \frac{y^2}{9} = 1$ D. $\frac{y^2}{9} + \frac{(x-3)^2}{16} = 1$

20. The equation of the asymptotes of a hyperbola with equation $\frac{x^2}{16} - \frac{y^2}{9} = 1$ is:

A. y = $\frac{3}{4}$x and y = -$\frac{3}{4}$x C. x = $\frac{3}{4}$x and x = -$\frac{3}{4}$

B. y = 3x + 4 and y = -3x + 4 D. x = 4y + 3 and x= - 4

Appendix F: Results of Pre and post test and Pr-post Attitude Scale of Experimental Group

Pre-test	Post-test	Pre-Attitude	Post-Attitude	No.	Pre-test	Post-test	Post-Attitude	Pre-Attitude
73	75	51	53	25	80	75	55	52
93	95	44	56	26	40	55	53	48

87	95	53	54	27	67	53	52	51
67	85	49	55	28	80	85	57	52
60	60	50	53	29	27	75	55	44
27	80	44	56	30	60	65	54	50
47	60	48	51	31	60	50	51	51
40	65	47	52	32	53	55	53	50
65	80	49	55	33	67	65	55	51
67	75	50	54	34	67	50	53	51
73	100	47	57	35	47	85	56	48
87	75	52	54	36	73	70	55	52
93	70	54	54	37	100	80	57	54
47	70	49	54	38	40	45	51	48
73	65	52	54	39	73	53	53	53
67	55	50	52	40	73	90	56	51
60	60	51	53	41	40	45	51	49
80	65	44	51	42	27	65	55	46
60	55	51	51	43	53	45	51	51
87	95	53	59	44	53	65	54	50
40	45	48	50	45	53	45	50	52
40	55	47	52	46	33	60	53	51
27	45	46	50	47	13	80	55	46
47	60	49	54					

Appendix G: Results of Pre-post test and Pre-post Attitude Scale of Control Group

Pre-test	Post-test	Pre-Attitude	Post-Attitude	No.	Pretest	Post-test	Pre-Attitude	Post-Attitude
73	55	51	52	25	73	55	46	48

67	50	43	47	26	60	50	52	53
53	45	48	50	27	33	25	51	52
93	75	51	53	28	47	15	50	50
73	50	52	53	29	80	60	47	52
87	60	54	49	30	67	50	54	50
60	45	51	46	31	53	40	51	49
100	85	52	54	32	40	20	50	52
53	40	44	46	33	73	55	49	51
47	40	46	47	34	40	25	50	51
87	65	51	51	35	60	50	53	53
40	35	49	44	36	20	20	49	50
33	35	41	51	37	93	70	48	50
67	55	52	47	38	40	35	51	50
60	50	46	48	39	53	35	48	44
47	40	45	50	40	80	65	50	51
53	40	49	45	41	47	45	51	48
80	65	51	52	42	60	40	50	49
60	50	51	51	43	67	55	53	52
40	35	48	47	44	27	30	51	50
53	50	47	49	45	13	25	48	46
27	25	45	46	46	20	20	49	45
80	65	53	53	47	13	25	43	44
27	20	47	45					

Appendix H:

Pretest result and group labeling of the sample students.**PT= pretest scoreG= Labeled group**

PT	G	PT	G	PT	G	PT	G	PT	G	PT	G	PT	G	PT	G	PT	G	PT	G	PT	G	PT	G

15	1	13	1	12	1	11	1	10	1	9	1	8	1	8	1	7	1`	6	1	4	1	3	1
15	2	13	2	11	2	11	2	10	2	9	2	8	2	7	2	7	2	6	2	4	2	3	2
14	2	12	2	11	2	10	2	9	2	9	2	8	2	7	2	6	2	6	2	4	2	3	2
14	1	12	1	11	1	10	1	9	1	9	1	8	1	7	1	6	1	6	1	4	1	2	1
14	1	12	1	11	1	10	1	9	1	9	1	8	1	7	1	6	1	5	1	4	1	2	1
13	2	12	2	11	2	10	2	9	2	9	2	8	2	7	2	6	2	5	2	4	2	2	2
13	2	12	2	11	2	10	2	9	2	8	2	8	2	7	2	6	2	5	2	3	2		
13	1	12	1	11	1	10	1	9	1	8	1	8	1	7	1	6	1	5	1	3	1		

Appendix I: Five weeks Course Plan for Coordinate Geometry

Name of the teacher: ShimelsTefera Name of the school:Hotie

Subject: mathematicsGrade:11 Allotted periods:21(15Hours)

Semester	Month	Date	Week	Topics and main contents	Allotted periods 21	General objectives of the unit	Rationale of the unit	Pre-requisite knowledge	pag
	November	10-14/3/2011	2	**unit-3 coordinate geometry** 3.1. straight line	2(each $1^{1/2}$hours) (3:00)	After completing this unit the students should be able to : - understand specific facts and principles about lines . - know how to solve problems related to straight line .	The concepts of lines occur in nature and are used in many physical situations in nature ,engineering and science	From grade 10 lesson about how to find equation of line	68-
		17-21	3	3.2. conic sections 3.2.1. cone and sections of a cone 3.2.2. circles	2 (each $1^{1/2}$ hours) (3:00)	-Know how to write down the standared form of equation of a circle . - know how to sketch the graph of the circle		from grade 10 coordinate geometry	77-
	November	24-28	4	3.2.3. parabolas	2 (each $1^{1/2}$ hours) 3:00	General objectives of the unit -understand how to find equation of a parabolas with its axis of symmetry parallel to one of the coordinate axes	-parabolic shapes have	From grade 10 coordinate	84-

						been used in designing automobile highlights reflecting telescopes and suspension bridges	geometry concepts	
	Dec em ber	1- 5/4/2011	1	3.2.4. Ellipses	2 (each $1^{1/2}$ 1hours) 3:00	know how to find equation of an ellipse whose center at the origin and different from the origin -Develop mathematical power among students to solve problems using usingdifferantmethods .	-Occur frequently as graphs of equations in Chemistry , Physics , Biology and Economics , - Boyle's law ,Ohm's law supply and demand curves		94-108
	Dec em ber	8-12	2	3.2.5. Hyperbolas	2 (each $1^{1/2}$ hours) 3:00	know how to find equation of hyperbola whose center at the origin and different from the origin Develop mathematical power among students to solve problems of hyperbola by design its graph and using formulas .		Grade 11 previous lesson	109-112

Appendix J: Sample Daily Lesson Plan for Experimental Group

Name of the teacher: ShimelsTeferaSubjectMathematicsGrade11 Date 17/03/11
Unit of the Lesson: Coordinate Geometry Topic of the Lesson parabolas
Rationale of the topic: Help for students to investigate their surrounding for objects that use in parabolas .
Pr-requisite knowledge: Grade 9 and 10 graphs of quadratic and even functions
Specific Objectives: - At the end of the lesson students will be able to

- Write the standard form of equation of a parabola whose axis is parallel to the x-axis
- Draw graphs of different types of a parabolas
- Solve problems of parabolas of the equation of directrix, the focus of the parabola, the length of latusrectum, vertex and equation of axis of symmetry.

	Time	Contents	Teachers Activities	Students Activities	Assessment Activities
Starter activity	**12'**	Activity 3.6 Graphs of quadratic functions	Motivate the students to draw graphs of the given quadratic function and find the axis of symmetry $Y= x^2+2x+3$, $y= -x^2+5x-$. 4.Guide by going round the desk if they are missing the concepts	Draw the graph of given functions by remember the lower grade concepts Show their attempt for each others and finally for the whole class .	Ask individually to show their graph and axis of symmetry .
Main activity	**60'**	Definition of parabolas and it different parts Equation of parabolas Whose axis of symmetry is // to x-axis Problems of parabolas	-Assign to different groups, - give a task to define parabolas and its different parts together with their groups , help in writing the standard form of equation in their own ,give problems of parabolas to solve by discuss in pairs and motivate to participate in the whole class discussions . Guide and support at each part of the lesson using the graphs model.	-Form groups. -discuss and present their attempt for other group and finally for the whole class , -write standard form of equations of parabolas by them selves -try to solve the given problems in pairs and discuss in other groups and finally shown for the whole class during presentation	Ask to define parabolas and other related parts Ask to write the standard form of equation of a parabola. Give problems to solve using each required formulas together with graphic representations.
Concluding activity	**18'**	Revision Ways of solving problems of parabolas whose axis is parallel to the x-axis	Revise techniques that help to more understand the concepts of solving problems of parabolas in short and ask to repeat what I said .Give class work and check their attempt Give homework ordered to perform carefully	Listen the Revision attentively. Explain what they have understand.-Perform the given class work individually and show for checking. Copy the homework questions	Ask to explain what they have listen. Give class work to check their understanding of the day lesson Give homework
T & L Materials					
Learner Support					

- Teacher's Signature _____ Date _____
- Recommendation of the Department Head _____

Appendix k : Sample Photos of Students taking Post Test