THE ATTITUDE AND ACHIEVEMENT OF LOWER ACHIEVER STUDENTS IN THE MATHEMATICS AND MATHEMATICS TUTORIAL PROGRAM; THE CASE OF GRADE 9TH STUDENTS AT ATSE NAOD SCHOOL

By

Tadiwes mamo

A Thesis Submitted to

The department of Science and Mathematics Education

Presented in Partial Fulfillment of the Requirements for the

Degree of Master of Mathematics Education

Addis Ababa University

College of Education and Behavioral Studies

Addis Ababa, Ethiopia

March, 2015

Addis Ababa University

College of Education and Behavioral Studies

School of Graduate Studies

This is to certify that the thesis prepared by Tadiwes Mamo, entitled: EVALUATION OF THEATTITUDE AND ACHIEVEMENT OF LOWER ACHIEVER STUDENTS IN THEMATHEMATICS TUTORIAL PROGRAM; THE CASE OF GRADE 9TH STUDENTS AT ATSE NAOD SCHOOL. Submitted in partial fulfillment of the requirements for the Degree of Master of Education complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by Examining Committee:

Examiner _____Signature _____Date_____

Examiner _____ Signature _____ Date_____

Advisor _____ Signature _____Date_____

Advisor _____ Signature _____ Date_____

Chair of Department or Graduate Program Coordinator

ABSTRACT

The objective of this study was to assess the effectiveness of a math tutoring program at a high school. This study sought to determine the effectiveness of mathematics tutorial program in the Atse Naod Secondary school setting for low achiever students, ninth grade students. The research participants included 80 students from high school population of Atse Naod School. The participants of this study included students who were part of a convenient sample. Participating low achiever students completed identical pre- and post- Likert-scaled surveys, which included statements about math and math tutoring. Additionally, students were administered a pre-assessment and a corresponding post-assessment that tested their level of performance in math. Analysis methods for this study included the evaluation of how many students selected each the "Strongly Agree", "agree", "undecided", "disagree" and "strongly disagree" option from the Likert-scale on the survey. In addition, both assessments were analyzed based on how students performed in each math concept category that was addressed on the assessment, as well as what percentage of students answered each item correctly. The results from a dependent t-test that compared the average scores from the pre- and post-assessment showed no evidence of statistical significance. However, there was evidence of improvement in the optimistic responses on the attitudinal survey from pre- to post-assessment. Furthermore, there was substantial improvement in specific math concepts represented in the higher-scoring percentage category from pre- to post-assessment. Overall, it has been concluded that many students who participated in the study will likely be more willing to learn about math since their attitudes toward it and performance in the subject have changed for the better.

ACKNOWLEDGEMENTS

First and ceaselessly, I would like to thank my God for his blessing in my life. Secondly, I would like to affirm my heartfelt gratitude and deep respect towards my advisor Dr, Mulugeta A, for his critical remarks and patience in all the way of my effort. Thank you very much!! Thirdly, I would like to thank my students and the academic staff who had been cooperative in all my work under this thesis.

Finally, I would like to show my cavernous thanks to my sister Rahel Mamo, my brothers Ato Yigremachew Mamo and Ato Yared Mamo, my friends ato Abdurahman, Ato Birhanab , Ato Netsanet, and Beti Yosef for their incalculable moral and material supports.

Contents page

List of table **page**

List of figures **page**

CHAPTER ONE

1. Introduction

1.1. Background of the study

In recent years, there have been an increasing number of tutorial class on the few private and government schools. Many of these programs were originally designed to meet nonacademic students. However, given the current emphasis on providing evidence of increased student's achievement, many tutorial programs are expanding their focus on support of students' achievement.

Tutorial programs have been touted as a means to increase the achievements of low achiever students and promote academic social and emotional, and behavioral growth by providing positive supervision while also offering academic programming. Some researchers suggested that after school programs can result in improvised outcomes for low achiever students. Such as, students demonstrate little skill growth and become dependent on their tutors for success (Ceprano, 1995; Keim, McWhirter, & Bernstein, 1996). Recently have experimental design studies examined the impacts participation in after school programs on lower achiever students' outcomes and this type of study that offers the only reliable source of causal evidence on program impacts. Knowledge of mathematical concepts is one of the all-important skills needed in order to function in most parts of society. Many may not realize that math is the tool that we use to make sense of our world in numbers. Not only are math skills needed for simple functions

such as calculating purchase totals and being able to read graphs to understand trends and patterns, but math is also an integral part of science as well. Many of the sciences (i.e. physical sciences, chemistry, astronomy, etc.) require proficiency in math, and the background knowledge associated with the sciences can be used for everyday problem solving.

Research has shown that implementing tutorials will promote student engagement and improve academic skills (Benard, 1999; Kalkowski, 1995; Martino, 1993; Miller et al, 1993; Topping, 1988). Enhancing skills in mathematics was one aim of the tutorials. If students' skills improve and they remain engaged for longer periods, then their mathematics comprehension should improve which paves the way to gains in achievement. In addition to affecting changes in mathematical performance, the interaction during tutorials can impact students attitudes toward learning (Topping , et al, 2003; Valeski & Stipek, 2001). Tutoring contributes to improvement in students Attitudes about school, which in turn reduces dropout rates, truancies, and tardies (Cohen, et al, 1982; Kalkowski, 1995; Martino, 1993). Research also supports that tutoring leads to an increase in students. self-esteem and confidence (Kalkowski, 1995; Gaustad, 1992) and promotes social skills by breaking down barriers and creating new friendships (Miller, et al, 1993; Kalkowshi, 1995). Additionally, tutoring provides emotional support and positive role models (Martino, 1993) .

Through the tutorial program at Atse Naod High School, a math tutoring program has been implemented in the hopes of helping low achiever students. The math tutoring program meets three times a week immediately after school in the school class for one hour. The study only contain 9^{th} grade low achiever students selected by the researcher and school administrator those students scored below 50. In addition, the four units, such as real number system, solving equations, expressions and inequalities, further on sets and relation and function are given by the

researcher to the low achiever students in the tutoring program. During a typical after school session, signing in for the day, it usually takes students about 10 minutes to settle down and start on their homework or assigned worksheet from their class cart. Each student or group's assigned tutor is responsible for keeping the tutor on task. Upon the clock reaching 3:45 pm, the tutorial class started and 4:45 finish the class.

Carlos (1985) suggested that subject matter tutoring for special education students by special education teachers may be unethical because students rarely acquires the skills necessary to become independent thinkers and learns through such tutoring. In fact, some such students demonstrate little skill growth and become dependent on their tutors for success (Ceprano, 1995; Keim, McWhirter, & Bernstein, 1996). Other researchers have reported mixed results. Some report that tutoring works sometimes and under certain conditions (e.g Cohen , Kulik, & kulik 1982; lapper, Drake, & Odonne 11-Johnson, 1997; McArthur,Lewis, & Landers, 1995). Others have reported that tutoring has been extremely effective intervention (Bloom, 1984) in short; the belief about efficacy of tutoring is mixed. This program consists of 9th grade lower achiever students. Math teachers who are willing to put in the afterschool time to help their students.

Ninth-grade mathematics tutorial programs describe a wide range of educational interventions intended to support students as they enter high school. One complicating factor in assessing these programs is that the program applies targeting to students academic, social, and affective behaviors all of which can play a mediating role in lower achiever students' transition to secondary education. As a consequence, substantial variation exists in the manner in which programs are structured and the performance outcomes that are measured. These programs, intended to anticipate and resolve issues that can complicate students' transition to the next grade. While all ninth-grade tutorial programs intend to help students particularly those lacking

fundamental skills make a successful transition into high school, the outcomes of program interventions can differ. Some focus on improving students' academic performance; others address affective factors, such as students' attitudes or beliefs about school.

Academic support services involve providing supplemental instruction to help lower-achieving students catch up to their higher-achieving. Academic delivery can take many forms including using tutors to provide more instruction (Cooledge & Wurster, 1985; Wasik & Slavin, 1990; Wilks & Clarke, 1988); providing students with an extra academic course (often called "double-dosing"); and offering pull-out services during or after school. Other forms of remediation programs may also be offered during the summer months (Cooper, Charlton, Valentine, & Muhlenbruck, 2000). In addition, specialized academic transition programs offered during or near the end of middle school may be introduced to curtail the achievement loss that students experience when making the transition from middle school to high school, especially for students who did not perform well in the middle grades (Alspaugh, 1998; Irvin, 1997; Barone, Aquirre-Deandreis, & Trickett, 1991).

Thus, the purpose of this study was to examine the effectiveness of tutorial program on mathematics class for a population of particular lower achiever students of ninth grade who were initially selected by the researcher, school administrator and were in danger of failing their ninth grade math in Atse Naod School, located in Arada sub city of Addis Ababa. A typical afternoon of math tutoring consists of 9^{th} grade low achiever students tutees. Math teachers who are willing to put in the afterschool time to help their students and others who need extra math assistance are there as well. The math tutoring program meets three times per a week immediately after school in the school's for one hour.

This study sees the effectiveness of math tutorial program in improving mathematics skills of high school (grade 9th students). Similar studies in Kenya, Liberia and South Africa by USAID have shown positive results' on students' performance (Ibid). Ethiopia has been at the forefront of the continents move towards improving access of education. Since the overthrow of the Derg in 1991, Ethiopia's primary education net enrollment rate has increased from less than 30% to more than 90%. This tremendously rapid increase in enrollment has been landed in a resent UNESCO Global Monitoring Report as an example of the type of government commitment necessary to make dramatic changes in enrolment.

Ninth grade tutorial programs intend to help students particularly those lacking fundamental skills make a successful transition into high school, the outcomes of program interventions can differ. Some focus on improving students' academic performance; others address affective factors, such as students' attitudes or beliefs about school. Although the later outcomes important, this review is confined to intervention strategies intended to bring about increases in students academic performance and engagement in school. To be included in the evidence base selected studies must have reported quantitative data on at least one of the following specific student outcome measures: test scores, grades, attendance.

To improve students' academic performance, some educators have develop intervention programs that primarily focus on students' social and emotional needs, in the belief that learning occurs when students are confident and motivated to achieve. These interventions which can include monitoring or social skill development are intended to assist students in making a successful transition to high school. Justified by studies documenting the benefits of positive adult influences and individualized attention (Flaxman, 1992; Jekielek, Moore, Hair & Scarupa,

2002), these approaches will often designed to change student attitudes, motivation or beliefs about school.

1.2 Statements of the problem

This study sees the effectiveness of tutorial program in improving the achievement of lower achiever students of high school students (grade 9th). Tutorial class will attempt to improve mathematics performance through the improvement of cognitive processes (e.g. working memory), However, tutorial focused on improving academic skills are more effective than tutorial attempting to improve cognitive process (Kavale & Forness, 2001). Hence, according to this source tutorial class more effective on the attitude of students. While communicating local and global review literature most of them are focused on achievement of students in mathematics subject through tutorial class. Therefore the research gap here is evaluation of students' attitude towards mathematics and mathematics tutorial program. Evidencing this I came up with possible suggestions.

Hence, the main purpose of this study is to examine the effectiveness of tutorial program for students in secondary education first cycle school (grade 9th) of Atse Naod School it is located in Addis Ababa Arada Sub city. Through this, students' performance in mathematics and their attitudes toward mathematics tutorial was assessed.

1.3. Objectives of the study

The main purpose of this is to see the effectiveness of mathematics tutorial program in improving mathematical skills of grade nine students in Addis Ababa Arada Sub city Atse Naod School. Based on the foregoing general objective, the researchers have set the following specific objectives of the study:

- ✓ To find out the influence of mathematics tutorial program in the academic achievement of students.
- ✓ To assess the attitude of students towards mathematics and to assess the attitudes of students towards mathematics tutorial program.
- ✓ To assess the component of attitude in mathematics.

1.4. Research questions

1) What is the influence of mathematics tutorial program in improving the academic achievement of lower achiever students?

2) What are the influences of mathematics tutorial program in improving the attitude of lower achiever students learning mathematics?

3) Is there a significant impact of the attitude and component of attitudes on the achievement in mathematics?

1.5. Significance of the study

The purpose of this study was to determine the effectiveness of mathematics tutorial class targeted toward low achiever students improved the mathematics achievement and attitude of students on mathematics and mathematics tutorial class. Furthermore, too many students appear unconcerned and exhibit negative attitudes towards learning in general and learning mathematics and mathematics tutorial class in particular. Many students enrolled in mathematics at the research site have below average scores.

To perform better in mathematics, students can get help from their tutorial who are more capable. Tutoring sessions will cause the students to interact academically as well as socially.

The results of such interaction should have a positive effect on either the achievement or the attitude of the learner, or possibly both. Positive attitudes towards mathematics lead students to be more receptive to learning and make teaching seem less of a challenge. Due to the many benefits associated with tutoring, this is the method that was selected for this investigation. The effects of tutoring were examined on mathematical performance on assigned tasks and attitudinal changes of students toward their learning experiences. This investigation was carried out to identify tutoring as a remedy for some of the challenges that students and teachers encounter such as failing grades in mathematics and poor attitudes towards learning experiences

1.6. Limitations

The time lapse that occurred between the pre-assessment and post-assessment consisted of approximately 16 weeks of tutoring. The pre-tests and surveys were distributed during second semester of the school year, and the post-test took place during the end of this semester. The mentioned duration represents a total of approximately four months. Many students' attendance rates dropped.

In general the following are limitations of the study

- Attendance rates especially dropped at the holly day. Easter allotted students time away from school that lasted about two weeks. As a result of this drop in attendance, many students from the pre-assessment lost motivation to remain involved in math tutoring, and as a result, no longer remained participants in the study.
- Although it was rare same students came late while I was providing tutorial class as the class time was arranged after the regular class.

Definition of Core Terms

Student Attitudes toward Math	This describes how the student feels concerning their ability in math, as well as the opinion they have come to form about the subject of math in general.
Student Attitudes toward Math tutoring	Student attitudes toward math tutoring describe how the students view the impact of the math tutoring program as connected to their proficiency and confidence in math.
Student Math achievement	Student math achievement is concerned with the results of their Pre- and Post-assessments.This primarily involves their numeric scores on these assessments.
Low achiever	students who had scored below 50 on their mathematics first Semester result.

CHAPTER TWO

2. Literature Review

2.1. Tutoring

2.1.1. Historical development

Tutoring as an age-old practice has a long and profound history that is expressed in different scholarly literatures. Jenkins and Jenkins (1987) cited by Kalkowski(2001) write ,tutoring instruction (parents teaching their offspring how to make a fire and to hunt and adolescents instructing younger siblings about edible, berries and roots) was probably the first pedagogy among primitive societies.

Due to the amount of research available that highlights the impacts of tutoring, it is clear that a number of researchers have taken notice of this avenue of learning. Though there has been a considerable amount of research done concerning tutoring programs, those dealing with underserved high school students such are not as well documented (Walker, 2007). According to Torstein,Husen (1995), organized and wide spread use of tutoring is credited by a Scots man called Andrew Bell who in the late 18^{th} century established a school for orphans of British Soldiers and Indian mothers in Madras,Idia. Bell adapted the ancient Hindu tutoring system and in 1797 reported on the successful application of individual and group tutoring for instruction and discipline. This method was further adopted and developed by the English educator called Joseph Lancaster and the method later on called Ben-Lancaster system. Different writings on the

issue pin-point a number of researched factors for renewed interest and mushroomed of tutoring, specially the peer tutoring practices in USA .Based on this and other similar facts tutoring is believed to be widely spread though out the world and especially in the USA ,and much of the research evidences conducted on the practice are supporting the effectiveness of it as a method and credited to play a great role in the expansion of tutorial services in the world.

2.1.2. Definition and concept of tutoring

Math tutoring can be defined as helping and supporting the mathematical learning of students in an interactive, purposeful, and systematic way (Topping, 2000). Tutoring can take place in small groups or in one-on-one sessions. Anyone can be a tutor. Tutors can be parents or other adult caregivers, siblings, other members of the family, peers, and various kinds of volunteers such as college students and retired members of the community. Most important, tutoring needs to be targeted to a student's individual strengths and needs through the cooperation of the tutor, student and teacher(s). (Harackiewicz, Barron, Tauer, Carter, &Elliot,,2000), defines tutorial program as a special instruction designed to help students catch up a desired level of academic achievement.

Literatures write Tutoring has positive effects on student achievement such as Cosden (2001) described after school programs as a "safety net" for disadvantaged children, and (Carryl 2005; Harris 2004; Miller 2003; Welsh 2002) found that tutoring programs provide the individualized help students need to achieve academically. In a literature review of academic tutoring and mentoring, Powell (1997;11) stated the tutoring is especially beneficial among disadvantaged students, "with learners showing greater than average gains in reading and mathematics and less absenteeism." Research also show that, after school tutoring helps students achieve improved academic performance in a number of ways. Students experience greater confidence levels

(Cosden, 2001), increased grades in school and higher completion rates in homework assignments (Brown 2003; Huffman,2001; Redden 2002; Rokach, Bauer & Oreck 2003; Jaylor 2001) and perform higher on standardized exams (Patrick 2006;Elbaum 2000; Powell, 1997; Welsh 2002). To encourage these positive impacts on student achievements, programs must have several key characteristics. In a study of several afterschool programs, Policy Studies Associates for the U.S. Department of Education (1995) identified a few of the characteristics critical to successful afterschool tutoring. First and foremost, non-certified staff needs high quality training (also supported by Miller (2003)). In addition, programs should connect with the regular school day curriculum and experiences so that students extend their learning throughout the day. Further, the Office of the Under Secretary, Planning and Evaluation Services for the U.S. Department of Education (1997) identified six factors that generate the most consistent positive effects on student achievement. These are: (1) Close coordination with the day school teacher; (2) Intensive and ongoing training for tutors;(3) Well-structured content and carefully scripted delivery of instruction;(4) Careful monitoring and reinforcement of progress;(5) Frequent and regular sessions between 10 and 60 minutes long; and (6) Specially designed interventions for children with learning disabilities.

These studies specifically examined the effectiveness and challenges of mathematics tutorial program, practice, or strategy delivered outside of the regular school day. Development was also informed by additional research related to mathematics instruction and afterschool programming, multiple site visit observations (at sites with multiple years of evaluation data validating overall increased math achievement), and the professional knowledge and expertise of the developers.

The practice of students teaching other students has a history that dates all the way back to the ancient Greeks (Campbell, Kyriakids &Robinson 2005). However, it was not until recent years

that peer-assisted learning gained attention in literature and it was at that time when the emphasis on this phenomenon shifted to focus on the benefits it provided to both tutors and tutees. In addition, the potential of tutors benefitting academically, combined with the lower costs and large selections of potential tutors, has contributed as a factor and enduring reason as to why tutoring is such a justified avenue for student learning (Roscoe & Chi, 2007). Tutoring can also be considered "same-age" tutoring. Same-age tutoring is the practice that has been put into place as the main teaching pedagogy in the tutoring program that is being studied. According to Roscoe and Chi,(2007) "in same-age tutoring, tutors and tutees are of a similar age or grade and participants are more likely to be actual peers because they attend the same classes or interact outside of tutoring." In the way that this particular program is structured, tutors are assigned to at least one person each, and on some occasions there may be one tutor working with up to three students at a time.

2.1.3. Benefits of tutoring

A tutorial is a method of transferring knowledge and may be used as a part of learning process. More interactive and specific than a book or a lecture; a tutorial seeks to teach by example and supply the information to complete a certain task.

The impact of tutor learning over the spectrum of academic subjects can also have an effect on tutors. Tutors seem able to learn through tutoring, no matter what subject they are teaching. Based on these findings and others, it is revealed that not only do tutees benefit from tutoring programs, but the tutors of the program gain from it as well (Cohen et al., 1982). However, math is among the subjects that may exhibit stronger gains than other programs such as reading (Roscoe & Chi, 2007). The data collected by John Schacter (2000) also shows that students working with other students increases learning and achievement. Cohen, Kulik, and Kulik

(1982), completed a comprehensive study that included 65 separate studies of different tutoring programs across the nation that have been identified as effective. Eight of these studies reported on student attitudes toward the subject area in which they were being tutored. In all eight of the studies documented by Cohen (2007), student attitudes were more positive in classrooms with tutoring programs, and in seven of the eight studies, self-concepts were more favorable for students in classrooms with tutoring programs. Additionally, Schacter (2000) found that students in tutoring programs performed significantly better than students in other collaborative learning-type programs. The authors of the meta-analysis also discuss how the programs "have definite and positive effects on the academic performance and attitudes of those who receive tutoring" and how tutored students outperformed their peers on exams. From these statements, it is clear that the potential benefits associated with tutoring programs can have remarkable impacts on the achievement of students.

Different studies of the effects of tutoring programs have included potential outcomes for minorities as well. Robinson (2005) discuss how in prior research it was "concluded that peer-assisted learning strategies were especially beneficial to minority students," and state how other researchers suggest that this could be true for minorities in a number of different domains, including mathematics (p. 330). Research also considers how strategies such as "collaborative learning approaches are known to have a positive impact on minority students' academic achievement." Furthermore, Roscoe and Chi (2007;330) again support the notion that such tutoring programs can have benefits for tutors and tutees, and this is one of the most appealing aspects of peer tutoring: the opportunity to support learning for both the tutees and the tutors.

2.2. Teaching Low Achieving Students

Teaching low achieving students math presents a unique set of challenges. These students normally don't believe they can understand math, they don't know why it is useful and they don't like it. But there are some methods that have been proven effective. Low-achievers need a lot of reinforcement. "For example, after-school tutoring has improved math achievement in low achievers (Hock, Pulvers, Desher, Schumaker 2001). This kind of math tutorial program is useful only if the student chooses to seek help. The parents may force them to go, but it's not effective if the student doesn't want to get help. Schools begin separating students based on skills with classes specifically for remedial math or for advanced math sometime around high school. The only compromise early on is that teachers can give advanced students more challenging work outside of school while giving everyone the same kind of lesson. These lessons could incorporate a few techniques which are proven effective to low-achievers. These methods are also effective to high-achievers and average students too. One of these methods is using pre-teaching. Pre-teaching gears students towards the lesson by having them start on the right track for the lesson. This may involve re-teaching some older concepts and organizing the ideas before actually giving the lesson. This works as an advanced organizer, which helps students understand the flow of concepts and increases understanding when the lesson is being taught. "As a relatively novel intervention, pre-teaching might serve as an instructional approach that reduces academic failure upon exposure to initial classroom instructional content, and subsequently affect academic self-concept." (Lalley, Miller 2006; 11).

2.3. Characteristics of low achievers

The literature abounds with lists of characteristics of students who have difficulties in learning mathematics. Most such lists can be divided into two sections: characteristics which arise from social and emotional problems, and characteristics arising from learning difficulties or

achievement failures in mathematics. We will focus on social and emotional characteristics first, and return to learning and achievement problems later. The slow learner in the junior high school has the same characteristics as other pupils of the same age; the same basic needs and interests.

Henry (2000; 18), in an address to a 1963 conference on the low achiever in mathematics commented that homes of low achievers " are physically and personally disorganized, life does not run on a time schedule, and so on. Thus, emotionally and cognitively, they lack the structure on which a conventional educational system can build.".

2.4. Attitudes of students and teachers towards mathematics tutorial class

2.4.1. Attitude of students towards mathematics tutorial class

Some students have developed negative stereotypes of science and scientists, whom they view as "nerds" or "mad scientists." Others describe scientists as "hard," "old," "frightening," and "colorless" (Rogers and Ford 1997). Several reasons have been suggested for these negative attitudes including students' undesirable experiences in previous science courses and with instructors, lack of needed skills to learn and apply scientific concepts, lack of motivation to work hard in science classes, home backgrounds, school and classroom environments, biases of peer groups, the media's portrayal of scientists, and students' perceptions of rewards associated with learning, to name a few (Rogers and Ford 1997). Science anxiety, the fear of science learning, and apprehension toward scientists and science-related activities are also results of these factors (Rogers and Ford 1997).

The way science is taught, at the high school level, also plays a major role in shaping students' attitudes toward science. According to a study by Cherif and Wideen (1992), which addresses the question of whether a problem exists for science students moving from high school to the university, students are being presented with selected aspects of scientific dogma at the high

school and university levels rather than being taught the innovative and visionary character of science and the value that such knowledge has to the educational process.

Though the development of desirable attitudes toward science is not the primary goal of introductory science courses, instructors usually recognize that attitude formation is one of the important aspects of instruction (Cherif and Wideen 1992; Garcia and McFeeley 1978). There is growing evidence that students who possess positive attitudes toward science will perform better academically. Russell and Hollander (1975), who created the Biology Attitude Scale a tool designed specifically to measure students' attitudes toward biology support this claim. "The tool was developed on the assumption that an important consequence of instruction is a positive change in the student's attitude toward the subject, and the authors argue the importance of focusing on attitudes by stating that there usually exists a positive correlation between attitudes and achievement" (Russell and Hollander 1975).

Although the impact of the intervention on tutors is not a primary concern, it is necessary to be aware of the potential influence of the tutors. Beliefs impact attitudes and attitudes affect performance; subsequently, performance and attitudes affect achievement. Research studies have been shown to link tutoring with achievement, performance, and attitudes (Topping, 1998; Stipek, 2001). The concept map is an attempt to display the relationship concisely.

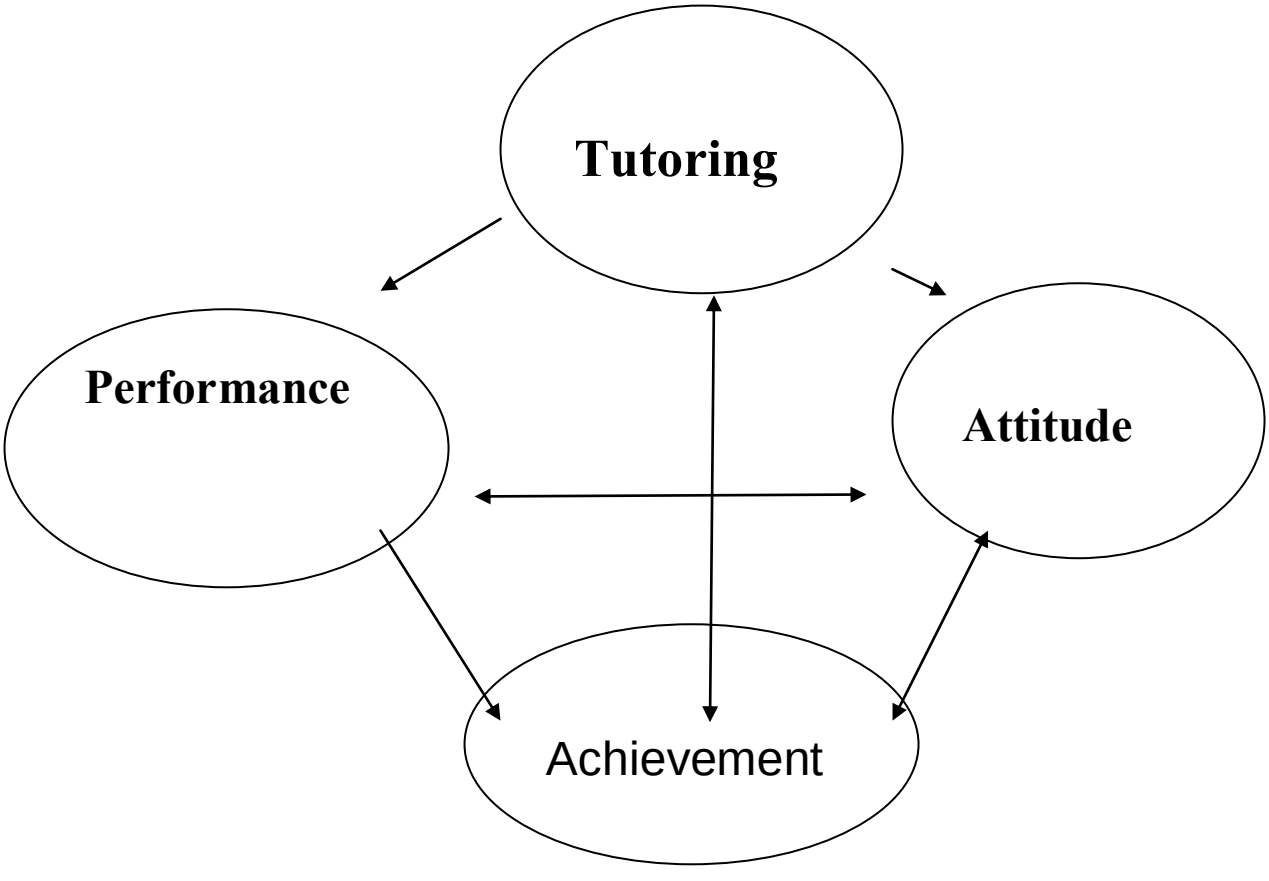

Figure 1. Relationships among various tutoring outcomes.

Tutoring may directly affect performance and performance subsequently impact achievement. In another possible path, tutoring may affect attitudes, then achievement via attitudinal changes. There is a bi-directional influence that relates performance and attitude and also between achievement and attitude. Developing a tutorial program has implications for increased success

in learning mathematics. Conceptually, this goal can be achieved through tutoring as it has been shown to improve performance, achievement, and attitudes towards learning in general (Cohen et al, 1986). The pathways of these related components are applicable to any academic endeavor and not only mathematics education. Every dedicated educator must desire and seek ways for students to learn more effectively through experimentation and hard work.

2.5. Challenges contributing to low achiever students

It is believed that, based on different findings, there are enormous factors that negatively influence girls and boys education at all low achiever students in particular. Odaga and Haneveld,(1995), in Teshome, (2002), categorized factors contributing for low academic achievement different headings; socio economic; socio cultural factors. .

2.5.1. Economic factors

The link between students achievement, economic circumstances and the risk of being a dropout is provided to be positive.(Goldman ,N Heney ,w, and Kofier et ,al .cited by Hijazi syed Tahier and Naquir Rosa ,2006;1) .It is clearly known that Ethiopians GDP is the lowest in the world . Moreover approximately 45 percent of people are estimated to living below the poverty line. This poverty as one aspect of economic factor has exerted its own huge negative influence on the enrollment of both boys and girls (Ross,2003;11). In this regard, almost all of low achiever students survive themselves and when one compares the negative influences of poverty on boys and girls, though it both of them are victims.

2.5.2. School related factors

School related factors includes the working environment, distance to school, teachers altitude and teaching practice, gender bias in curricula and class room culture (Teshome 2002). The

writer also cites the poor quality of teaching learning process in the class room and the unattractive learning environment for students as a case for low academic performance.

Challenges of teachers and students towards mathematics tutorial class

Challenges of teachers

The challenge of teaching students having learning difficulties in mathematics is great. Another curricular "happening" during the 1960s, made possible by extensive funding by federal government and other agencies, was that of special projects devoted to low achievers and their problems. Over 40such projects were identified by the Committee on Mathematics for the Non College Bound, appointed by The National Council of Teachers of Mathematics. And one message from these groups is loud and clear: Once a teacher has managed to generate a classroom situation highly conducive to learning mathematics and has witnessed the responses of "slower" students to these situations, remarkable things happen. Enthusiasm grows, spirits lift and low-achieving classes become an opportunity and challenge for both students and teachers.

Many of the innovations and points of view of the projects for low achievers are reflected in the review of teaching resources which follows. Those of us who prepared this paper are hopeful that other teachers of low achievers can find help and encouragement here for bringing new opportunities and challenges to their own classes.

The Challenge of High School Entry

The freshman year in high school can be one of the most emotionally difficult, academically challenging events in a young person's life. Occurring during the middle stage of adolescent development, when youth begin to exert their own independence and complete their physical development, high school entry often introduces a unique set of challenges that can adversely affect the learning process. As youth are plunged into an unfamiliar, often chaotic school environment, unsure of institutional norms and expectations, and granted an unprecedented degree of independence, many initially struggle to adapt to their new surroundings.

At the onset, social changes associated with high school matriculation can be disconcerting to youth, who find themselves thrust into a complex new environment often filled with a larger, more diverse student population. This change from being the one of oldest, most knowledgeable students to one of the youngest, least experienced can contribute to feelings of anxiety and isolation (Blyth, Simmons, & Carlton-Ford, 1993). Because high schools are seldom structured to ensure that students receive support services and individualized attention, students who lack the social skills and motivation can begin school at a disadvantage (Alliance for Excellent Education, 2003).

Academic demands also increase, with students facing new expectations that require more advanced learning skills. In particular, students are expected to master a host of critical thinking, written, mathematics, and communication skills that form the basis for their subsequent education (Roderick, 1996). While average class sizes in high school are generally similar to those in middle school, ninth-graders often perceive high school as larger, more competitive, and more grade oriented than middle or elementary school (Alt & Choy, 2000; Eccles, Midgley, & Adler, 1984). Not all students respond well to these new conditions, and their transition from middle to high school is associated with declines in academic achievement for nearly all youth

(Alspaugh, 1998). For example, Roderick (1993) documented that, on average, students experience an 18 percent drop in grades following high school entry, a fall equivalent to two letter grades. Research has also documented an increased incidence of course failure and declines in attendance (Roderick & Camburn, 1999; Blyth, Simmons, & Carlton-Ford, 1993).

Student Motivation and Math Achievement

A major part of this study will be to determine how students' attitudes toward both math and math tutoring change from the start of second semester to the latter end of the school year. Concerning student attitudes toward math in general, research generally shows that students do not "associate math activities with enjoyment" (Mitchell, 1999, p. 1). The logic of my expecting students to side with negative connotations of math comes from my peers' and my own not-so-great opinions of the subject as a grade school student. It takes work and practice to master math skills, and at first, many students are not eager to put forth the effort to do so. Another reason for this hypothesis stems from hearing students say things like "I can't do this" and "I don't get it" when trying to reason with them while working through a math problem during math tutoring.

Through conducting this study and even through participation in the program as an adult tutor, the researcher found that many students' attitudes toward math are affected by their peers' attitudes toward math. The researcher even noticed that many students had been attending math tutoring after school with friends in the class., because peers participate in math tutoring together, they have the same attitudes toward math.

Motivation is an external factor of learning and classroom structuring, but it is also a byproduct of successful implementation of classroom instruction. Weber (2008) noted in a study of a female student who did not become interested in math until she understood the course material

better. After experiencing small successes, the students were motivated to try harder at the coursework and to seek out opportunities to study further. The positive aspects of learning motivated the student to learn mathematics. Frye (2010) further discussed motivation strategies that can work with middle school students. Frye iterated that middle-grades students' transition "to middle school with beliefs and experiences from elementary school that influence their motivation and learning" (p. 61). With this assumption, Frye implemented a system of allowing students to self-assess their work in addition to receiving teacher assessment and noted the students' successes by telling how few re teaching modules were needed after each assessment.

A great importance exists for students to be ready to learn, and the role of the classroom teacher is to make sure they are ready to learn, even if the students are unmotivated (Ball & Forzani, 2010). Ball and Forzani suggested that teachers need to understand not only what to teach, but how to teach the material, suggesting that teachers have a good idea of what is relevant and should be ready to present such information in a manner that students can understand. Similarly, Risser (2010) found students performed better in class when they had identified external factors in a positive manner rather than negatively. Motivation can be a historical piece of student data that will typically be consistent, regardless of the student's instructional level (Carbonaro 2005; Bahr, 2009). Finding correlations between student motivation and success would help educators better understand how to structure schools, courses, and even the material therein. The benefits of such discoveries could have long lasting effects for individuals, schools, and school systems seeking solutions towards remediation. In a tertiary preparatory course at the University of Southern Queensland, Carmichael and Taylor (2005) found that motivation was a strong predictor of success. In their study, "students' assessments on their confidence to successfully

undertake mathematics questions is based, in part, on their current level of knowledge and skills, and that this will influence their ultimate performance" (p. 718).

Teacher Preparation and Math Achievement

Teachers' knowledge of mathematics material could determine student understanding and ability to learn in class. Kajander (2010) found that some teachers had a weak knowledge of material needed for teaching. Reasons given by Kajander came from deficiencies in teacher preparatory classes. As the standards-based classroom becomes more of a reality with new legislation, teacher preparation must occur for delivery of those standards. Thompson (2009) examined teacher preparation toward student math and science performance in the secondary classroom. The study found that the standards-based classroom strategies contributed to higher scores than the classroom instructional strategies that were not standards-based. Kajander noted that no particular strategies were supported as being consistently effective toward student math achievement in the standards-based classroom, suggesting that teachers needed to have training in teaching math that was perhaps different from what they had learned while in school.

A gap exists in the current area of research for high school mathematics tutoring programs for the purpose of student achievement, as there are few studies that are specific to this area of focus. Wondimu kebede (2007), the effectiveness of tutorial program on female students, Similar and correlating studies help to foster an understanding of this gap, which is necessary in encouraging student success. Design of the programs is important as instructional time must be adapted and utilized in the most effective means. Many times the design itself will yield success or failure. The purpose of the math tutorial class in this particular study was to create higher test scores on the tests for low achiever students. The previously outlined studies helped explain what specific gap existed in the research, as well as the overall course for the students.

Classroom instruction and student learning were closely linked; the need for a study to analyze the relationship that existed for a treatment strategy that was employed by four middle schools and the outcomes of students' summative exams was imperative. If exams are an important indicator of learning, then there must be a treatment that will help students of differing learning abilities. The constructivist mode of thinking supports this belief and this study sought to bridge the gap that exists within the research. The next three chapters guide the study itself as the overall setup of the study, the analysis, and the discussion of the analysis are addressed. Chapters 3,4, and 5 discuss a methodology that will guide the study, provide the results from the analysis described in Chapter 3, and discuss the results seen in Chapter 4.

CHAPTER THREE

3. RESEARCH METHODS

3.1. Introduction

The purpose of this study was to determine whether or not receiving a tutorial math class (in addition to a regularly scheduled math class) targeted toward improvement of the math achievement of lower achiever students. This is important because the results of this study can be used to interpret the effect of this program may have on students over time. Also, the results of the study can be used as evidence to support the implementation of tutoring programs as a resource for student success in mathematics. To best answer these research questions and determine the significance of mathematics tutoring, statistical measures of collecting pre and post intervention data was used throughout this investigation. As defined by Creswell (2003), a quantitative approach is one in which the investigator thinks of cause and effect and plans to use measurements and observations to test theories. This chapter presents the methods, research design, participants, settings, instrumentation, procedures and data analysis.

3.2. Researcher Role and Participation

I was familiar with the students involved in this study. Therefore, as I gathered data, I was already aware of what some students were capable of concerning performance ability. Due to my familiarity with the students, there were certain personal expectations of achievement that I would have liked to see present in the results. Keeping this in mind, my goal in this study was to remain as objective as possible in the review, analysis, and reporting of the data. Additionally, concerning the students' consent in participation, they were made fully aware of the purpose of this study, as it had been communicated to them verbally. Furthermore, through a thorough understanding of the setting and participants, I attempted to extract any effects that my presence may have caused in this study. Finally in describing my role as the researcher, I am the teacher, primary data collector, and tutor trainer.

3.3. Research Design and Methodology

A researcher does not arrive at the design of a study through selection. The research questions dictate the design. To best answer these questions and determine the significance of the tutoring intervention, statistical measures of collecting pre and post intervention data were used throughout this investigation. As defined by Creswell (2003), a quantitative approach is one in which the investigator thinks of cause and effect and plans to use measurements and observations to test theories.

Quantitative methods which are best suited for measuring variance were employed for this student population. This study is structured upon quasi-experimental design, which is defined as "procedures in quantitative research in which the investigator determines whether an activity or materials make a difference in results for participants" (Creswell, 2005, p. 51). The quantitative research is represented by the numerical data that is being collected from the scores on pre- and post-assessments as well as on Likert-scale pre- and post-math attitude surveys. According to

(Creswell, 2005) quasi-experimental design is used when the investigator wants to detect a potential cause and effect between independent and dependent variables. In this case, the independent variable represents the math tutoring program, while the dependent variables are the participants' attitudes toward math and their math performance abilities based on the pre- and post-assessments. In a typical experimental design, the investigator would "attempt to control all variables that influence the outcome, except for the independent variable," (p. 15) so that if the independent variable does influence the dependent variable, then it could be said that the independent variable "caused" the change in the dependent variable. However, this study is not a standard experimental design with random assignment of participants to groups. As the investigator, the researcher was not able to control all outside influences on the subjects of this study especially concerning students' outside factors that may contribute to their participation in the math tutoring program. Therefore, if students decided to discontinue their participation in math tutoring, he could not control that decision.

In reference to the specific type of quantitative research design that is being used, this study is classified as a quasi-experimental design. A quasi-experimental design includes a pre-test as well as a post-test, where the participants are those who are part of an already intact group (Creswell, 2005). In the case of the math tutoring program, the quantitative participants are those who have already chosen to attend the after school math tutoring sessions the students were not specifically chosen by me. Therefore, these students serve as the quasi-experimental group, and in keeping with the design, are administered a pre-test, then exposed to experimental treatment activities (math tutoring sessions), and are then given a post-test. In general, this simple design serves as a basic structure to logically analyze the impact the math tutoring program has on its participants.

3.4. Instrumentation

Surveys and Assessments

Quantitative analysis and descriptive analysis of the results from the distributed math attitude surveys, pre- and post-assessment overall scores, and individual item analysis for all three instruments using this survey as a base, it was altered so that the positively-worded statements addressed both math's in general and the math tutoring program. The survey distributed to students was a 10-question positively and negatively worded instrument, which is relating to math And 30 questions concerning math tutoring. The students were to answer the statements using the Likert-scale options "Strongly Disagree," "Disagree," "Agree," "Strongly Agree," or "No Opinion." Additionally, the pre- and post- tests, which are the same instrument and the instrument, contain 20-question math assessments were then compiled math questions that were related to the math tutoring students' current class.

3.5. Sampling Method & Sample

3.5.1. Sampling

Purposeful sampling was employed due to the nature of the procedures in mathematics at the high school 9th grade lower achiever students. Initial sampling distributions were based upon student achievement (educational rating) and performance (test score). Eighty students were chosen from the initial population for participation in the study.

3.5.2. Participants

The participants of this study included students who were part of this sample. Students were not randomly assigned to this study, but were purposefully selected by their teachers and administrators, based on the students' first semester scores. The criteria were used to identify

which students qualified for the sample used in the study. The students' first semester ninth grade had to score below 50 on the mathematics.

This indicates that low achiever students who had been math tutoring attendees were low scored students in the first semester result. And those lower achiever students asked to come to an afterschool math tutoring session on a specified day, and those who were in attendance were distributed a math attitude survey depending on the class in which they were enrolled at that time. The population of students was 80 of which 28 male students and 52 female of 9^{th} grade students.

3.6. Validity and Reliability

The instrument was tested for reliability and validity. Validity was demonstrated by studying the results of this group and more than 10 hours of student interviews. Procedures were in place throughout the investigation to ensure reliability of measurement and instruction. Additionally, the Cronbach alpha coefficient was used as a measure of internal consistency for the original survey attitude of students towards mathematics with a value of 0.87 indicating that the survey was both useful and reliable.

3.7. Data Collection

Pre- and post-intervention data was gathered from the students who were the tutees. The results were organized, analyzed, interpreted, and represented in tables and graphs, for a complete report of the data and findings of the researcher. The researcher records were used to gather data from low achievers students. Preliminary results helped to identify the effectiveness of mathematics tutorial program to implement in the school. Data was collected from tests and surveys. The

researcher gathered pre and post survey data for the attitude of low achiever students on mathematics and mathematics tutorial class.

This information proved critical for examining participants attitudes toward learning mathematics. Data collection took place prior to the tutoring intervention and at the conclusion of the study. For the purposes of confidentiality, surveys were stored in the school store.

3.8. Data Analysis

The study involved a pretest and posttest design; therefore, ANOVA (analysis of variance) and regression analysis was used in data analysis. Due to the design and population of the study, statistical measures were supported with qualitative data to provide a clearer representation of the overall effects obtained in this study. Quantitative analysis to be followed by thick, rich descriptions of attitudinal categories created by the researcher of the survey.

In order to appropriately analyze the quantitative data collected from this study, a computer software program called SPSS, which stands for Statistical Package for the Social Sciences (SPSS) was used. This particular software program has been applied to process the data in a logical, easy-to-read fashion. The data was broken down into sections that described the answers to questions in depth according to the percentage of students who chose each option for each question. The frequency for each question was also shown by SPSS. In addition to SPSS, Microsoft Excel was used to process the data for the project as well. In Excel, several statistical tests were run to analyze the data.

In the analysis of the data, discussion concerning what statements on the survey received overwhelming responses on either end of the Likert-scale took place. The problems on the math assessment which proved the most difficult for students have been analyzed, as well as those which received majority correct responses. Also, the pre- and post- survey and assessment results were compared in order to analyze any significant change in performance. Furthermore, paired sample t-test was used to compare the overall scores of the pre-assessment versus the overall scores of the post-assessment for each participant. The type of analysis that took place for each research question was different. Research Questions two "2) what are the influences of mathematics tutorial program in improving the attitude of lower achiever students learning mathematics? Finally, Research Question one and three, 1) "What is the influences of mathematics tutorial program in improving the academic achievement of lower achiever students?" and 3) is there a significant impact of the attitude and component of attitudes on the achievement in mathematics? Was evaluated using descriptive analysis, as well as a dependent t-test for paired samples? I believe that using descriptive analysis for each research question was appropriate. Statistics need to be explained in a way that is understandable to any audience, even those who have no background in statistical analysis. Descriptive statistics "indicate general tendencies in the data, the spread of scores, or a comparison of how one score relates to all others" (Creswell, 2005, p. 181). If these general vitals are shared with the audience, then a more logical understanding can be attained by the reader. In reference to Research Question Three's analysis through a dependent t-test for paired samples, this type of test was run through Microsoft excel. The "dependent t-test for paired samples is used when the samples are paired. This implies that each individual observation of one sample has a unique corresponding member in the other sample." In the case of the study of the math tutoring program at Naod High School,

a certain number of students had a sample (score) from the pre-assessment and a sample from the post-assessment. This is true for the pre- and post-surveys as well. In general, there has been consistent evidence that explains the appropriateness of the chosen types of data analysis for this study.

The current study employed a quasi-experimental design because this approach best answers the questions which guide the research. Quantitative methods of data collection used for the selection of dyads were followed by qualitative methods of investigating the attitudinal impact of the tutorials. The focus was only on the impact on tutees not the tutors. As trained calculus students tutored students in prerequisite mathematics courses, it was anticipated that student scores in mathematics would increase.

Attitudes towards learning mathematics would improve as a result of these tutorials. Subsequent chapters unveil the results of this research investigation and implications for future research studies. Every classroom is unique and the strategies used for this study may require modification for use within a specific class setting. Teachers should conduct further research and identify those techniques which work best for their particular design, learning environment, or student population before implementation of any type of peer tutoring program.

CHAPTER FOUR

4. DATA ANALYSIS AND INTERPRETATION

4.1. Introduction

The purpose of this quasi- experimental study was to determine whether or not receiving a mathematics tutorial class (in addition to their regularly scheduled math class) targeted toward student success on testing improved the math achievement of lower achievers ninth grade students.

The analysis of the effectiveness and challenges of math tutoring program has led to answers of the following research questions: 1) what is the influences of mathematics tutorial program in improving the academic achievement of lower achiever students? 2) What are the influences of mathematics tutorial program in improving the attitude of lower achiever students learning mathematics? 3) Is there a significant impact of the attitude and component of attitudes on the achievement in mathematics? These questions have been designed in order to gauge the impact of the math tutoring program.

This study investigated the impact of a four month, after school session of mathematics tutoring on students' academic achievement in mathematics subject and their overall attitudes towards learning mathematics and mathematics tutorial class. Specifically, the study sought to determine whether or not participation in mathematics tutorial had a predictive effect on student achievement on the low achiever students and mathematical attitude. The participants included 80 students from ninth grade students of Addis Ababa Arada Sub City in Atse Naod primary and secondary school.

4.2. Background of respondents

The participants included 80 students from a high school population of Atse Naod School. The participants of this study included students who were part of a purposeful sample. Students who scored below 50 in the first semester result who had been math tutoring attend were asked to come to an afterschool math tutoring session on a specified day, and those who were in attendance were distributed a math attitude survey depending on the class in which they were enrolled at that time. As seen in the table the most participants in the research are female as indicated in the table 1, 65% of students are female and 35% of students are male on the research.

Table1.The number of participants

Variable	N	%
Female	52	65.0
male	28	35.0
Total	80	100.0

4.3. Pre-assessment Results

Upon the evaluation of the results of first semester mathematics, and pre-test that was administered to 80 students. The test item was put into a percentage category as well as a mathematical concept category. The percentage categories were as follows: more than 50% of the students answered the item correctly, between 40% and 50% of the students answered the item correctly, or less than 40% of the students answered the item correctly. The math concept categories included Category 1: “real number system” (three items total) Category 2: “solving equations, expressions, or inequalities with variables” (seven items total), Category 3: “further on sets” (six problems total), and Category 4: “relations and functions” (four problems total).

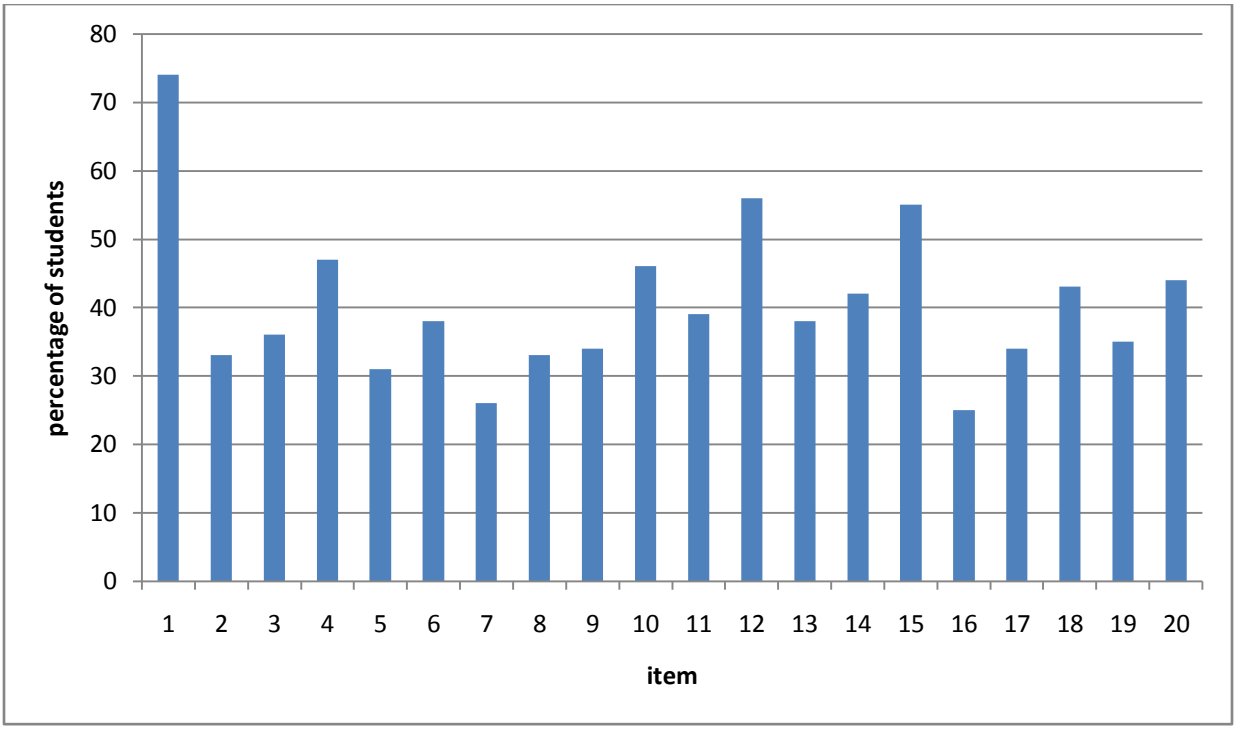

Figure 2 . Percentage of Students who chose the Correct Answer per Pre-assessment Item.

For the “less than 40%” category, twelve out of twenty questions were put into this group, the items included numbers 2,3,5,6,7,8,9,11,13,16,17 and 19. Out of the twelve questions in this group, two of the items involved “real number system,” five of the items involved “solving equations, expressions, or inequalities”, three of the problems entailed “further on sets”, while the remaining two items in this category required students to “relation and function.” The lowest scoring item out of this group, and out of the entire selection of questions on the assessment was item number 16 with 25 .4% (n=20) of students answering it correctly. This item asked students word problem on sets.

In reference to the “between 40% and 50%” group of questions, this category represented items on the pre-assessment where between 40% and 50% of students answered them correctly. The questions included numbers 4,10,14,18 and 20. Two of the items involved “solving equations, expressions, or inequalities”. One problem in the category, students were required to “further on sets” and the last two items dealt with students “determining increasing function and combination of function”

Concerning the “more than 50%” section of questions, the items represented reflected those of which more than 50% of students answered correctly. The items in this category consisted of numbers 1, 12 and 15. One of the questions required students to “real number system” and two more problems asked students “on sets.” The highest scoring item out of this group, and out of the entire selection of questions on the assessment, was item number 1 with 74.2% (n=60) of students answering it correctly. This item required students to interpret a graphed function of distance versus time. According to the items represented in the highest category (“more than 50%”), students were already familiar with a few key mathematical concepts. The concepts included knowing how to find GCF and LCM of numbers based on given input and output values

of a function (item numbers 1), determining the number of subsets and proper subsets (item number 12), and knowing how solve ,by equating ordered pairs (item number 15). See Figure 3 for the overall number of pre-assessment items per percentage category.

In relation to the three remaining questions that have not been addressed, these items proved to be troublesome for students, considering the statistical findings that were produced. The questions of focus, which fall under the "problematic item" category, signify those of which the results showed more students chose an item similar to the correct answer rather than the actual answer. These "problematic items" included questions number 7, 8, and 16. The answers for these questions showed a definite misconception among students, which can be explained in a number of different ways.

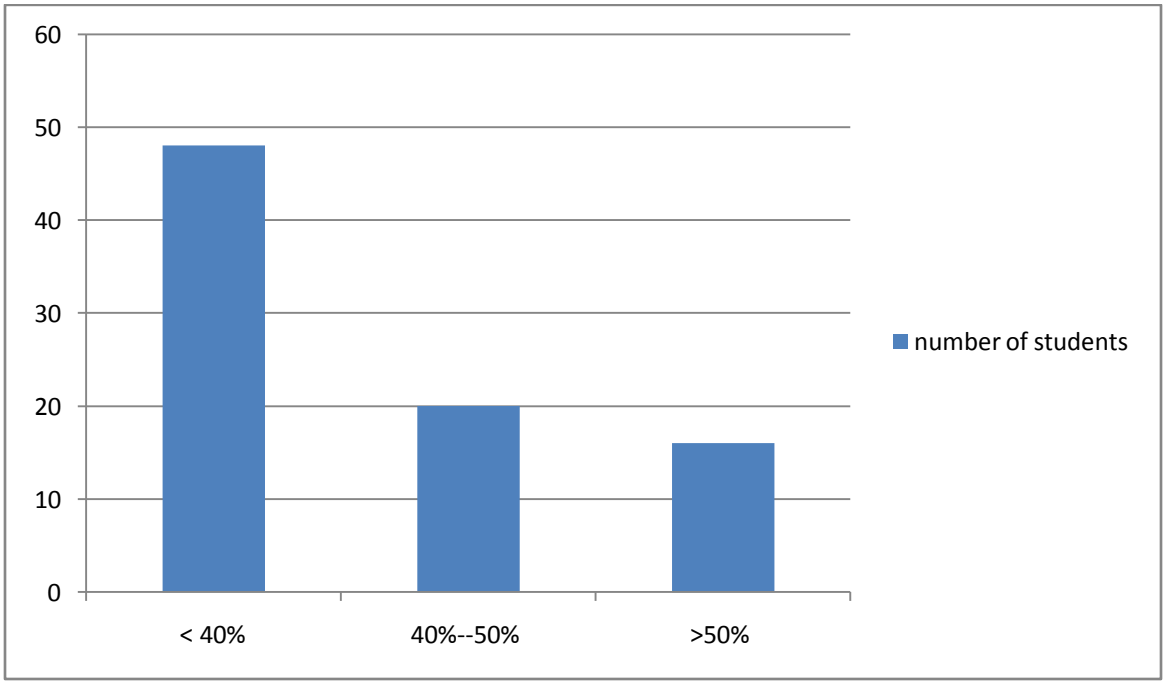

Figure 3. Overall Number of Pre-assessment students per Percentage Category.

This set of data is the overall results of the pre-assessment. The student was sited to a percentage category and was analyzed according to the percentage of students who chose each particular

option. This analysis revealed several ideas behind the data. According to the above figure 3 forty eight students out of eighty students were scored less than 40%, the remaining 20 students were scored between 40% and 50%, and 12 students were scored greater than 50%. The pre assessment result indicate most of the students from the total of eighty students 48 students were score below 40, whereas only twelve students were score greater than 50. And twenty students were score between 40 and 50. Before tutoring these showed that students did not have more understanding on the content associated with those questions. The associated content included solving equations, inequalities, and expressions with variables as described in story problems, interpreting equations with variables based on word problems, and understanding graphed functions as explained through story problems.

Intervention

In order to provide a potential solution to this problem, the school leaders arrived at the decision to create an intervention class designed to provide intensive treatment for students with first semester result of grade 9^{th} students. Thus, the purpose of this study was to examine the effectiveness of a mathematics tutorial class for a population of 80 ninth grade students who were initially selected by the researcher and were in danger of failing their first semester mathematics results of grade 9^{th} students Atse Naod School located in Arada cub city.

4.4. Post-assessment Results

The post-assessment was given to student four months after the pre-assessment was administered. There are a few significant details to keep in mind concerning the post-assessment in relation to the pre-assessment. 80 of the students participated in the post-assessment, compared to the 80 who took part in the pre-assessment as part of the convenient sample. As

with the pre-assessment results, the post-assessment results have been divided into percentage categories. The post-test categories are the same as the pre-test categories “less than 40%”, “between 40% and 50%”, and “more than 50%,” all referring to the percentage of students who answered each question correctly.

In accordance with the pre-test analysis techniques, the post-assessment questions have been labeled based on what mathematical content each item addresses. Identical to the ones from the pre-assessment, the math concept categories consist of “real number system”(three items total) “solving equations, expressions, or inequalities with variables” (seven items total), “further on sets” (six problems total), and “relations and functions” (four items total). View table 3 for post-assessment correct answer percentages and for the overall number of post-assessment items per percentage category.

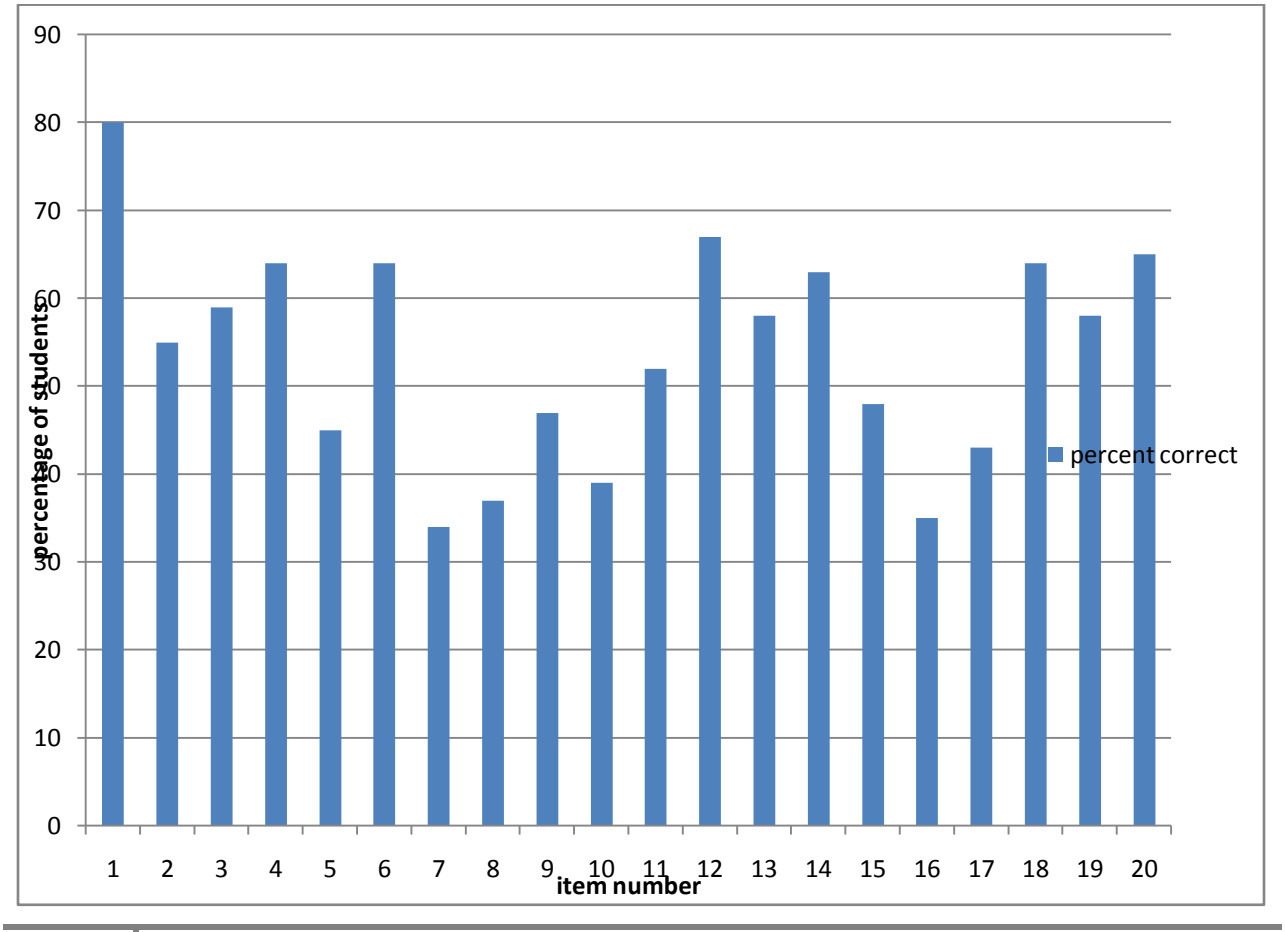

Figure 4 . Percentage of Students who chose the Correct Answer per Post-assessment Item.

For the “less than 40%” category, only four out of twenty questions were put into this group. The items include numbers 7,8, 10and 16. Out of the four questions in this group, three of the items involved “solving equations, expressions, or inequalities”, and one of the problems entailed “further on sets.” The lowest scoring items out of this group, and out of the entire selection of questions on the post-assessment were item numbers 7 with 34% (n=21) of students answering it correctly. Item number 7 asked students to find the root of quadratic equation one root is given in terms of the other and the constant term from the equation is unknown.

In reference to the “between 40% and 50%” group of questions, this category represents items on the post-assessment in which between 40% and 50% of students answered them correctly. The questions include numbers 5, 9, 15 and 17. Two of these items involve “solving equations, expressions, or inequalities”, one problem in this category, students were required about “further on sets” and one problem on “relation and function”.

Concerning the “more than 50%” section of questions, the items represented reflect those of which more than 50% of students answered correctly on the post-assessment. The items in this category consist of numbers 1,2,3,4,6,11,12,13,14,18,19 and 20. Three of these questions required students about “real number system” and two more problems asked students to “solving equations, expressions, or inequalities,” four items involved “further on sets”, and three problems asked on “relation and function”. The highest scoring item out of this group, and out of the entire selection of questions on the assessment was item number one with 80% (n=63) of students answering it correctly. This item required students to determine the GCF and LCM of a number. This set of data has yielded fascinating results relating to the general outcome of the post-assessment. For a second time, designating each item to a percentage category and analyzing

each item according to the percentage of students who chose each particular option, revealed several strong meanings behind the post-data. The students still showed signs of struggling with six out of the twenty questions on this assessment. Their responses for the post-assessment were not as scattered as the pre-assessment; however, the participants display a significant difficulty with the concept of word problem. Out of the seven questions on the post-assessment, four of them involve problematic item. Two out of the remaining questions are concerned inequalities. In general, there was a significant change from the pre-data to the post-data one that may serve as an indication of promising impact.

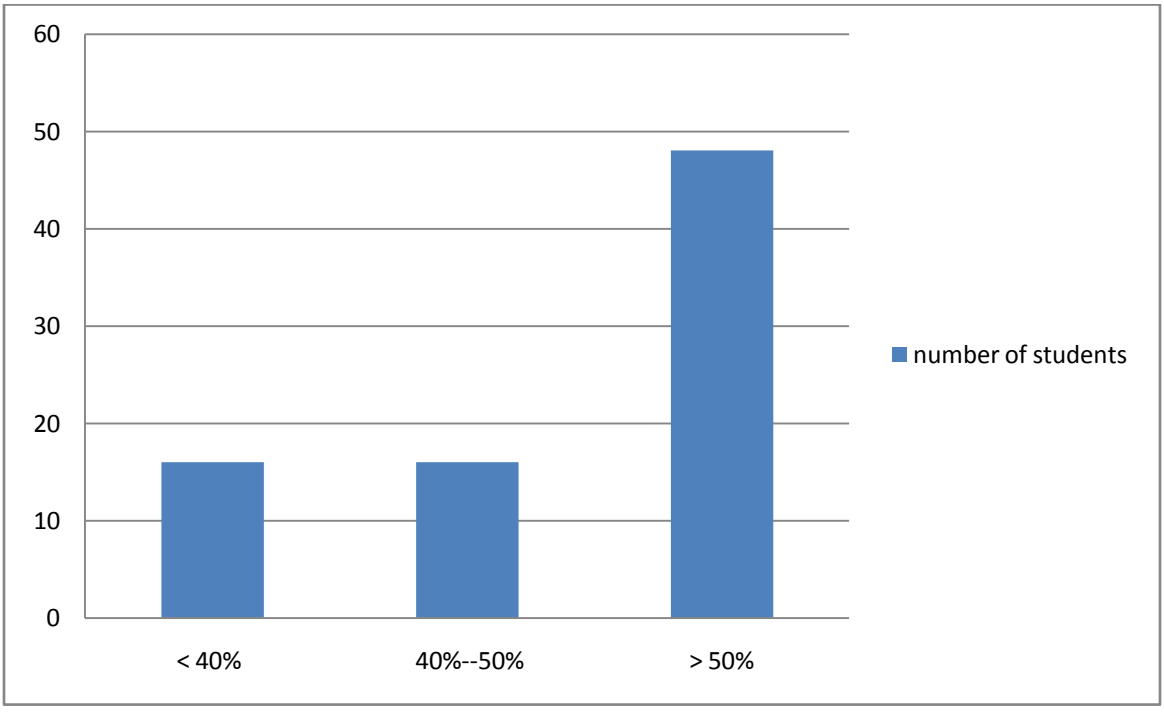

Figure 5. Overall Number of students on Post-assessment result

According to the score of students on the post assessment represented in the highest category ("more than 50%"), students' understanding of concepts have been enhanced concerning how to make sense of many related concepts. In addition to what students already knew as displayed by the pre-assessment results, on the post-assessment, students exhibited their newly developed

knowledge of solving equations through different problems. This set of data is the overall results of the post-assessment. The student was sited to a percentage category and was analyzed according to the percentage of students who chose each particular option. This analysis revealed several ideas behind the data. According to the above figure 5 sixteen students out of eighty students were scored less than 40%, and sixteen students were scored between 40% and 50%, and forty eight students were scored greater than 50%. The post assessment result indicates most of the students from the total of eighty students (48 students) were score greater than 50, whereas only sixteen students were score below 40. And sixteen students were score between 40 and 50.

4.5. Pre- and Post-assessment Differences

Many changes occurred between the pre-assessment and post-assessment results. Most noticeable is a shift that took place between the arrangements of items in each percentage category. Both assessments were evaluated through the analysis of three percentage categories: “less than 40%”, “between 40% and 50%”, and “more than 50%,” with each category referring to the percentage of students that answered each question correctly. The pre-assessment outcome originally consisted of twelve items in the “less than 40%” category. However, the post-assessment resulted in only four items in that category, which is a noteworthy shift. In the “between 40% and 50%” group, the pre-test contained five items. Invariable results came about from the post-test, as the students’ responses yielded four items in the category. Finally, serving as the highest grouping out of the three percentage groups, the “more than 50%” category generated three items for the pre-test, however, the post-test revealed a more knowledgeable sector of students by exhibiting a remarkable shift from three items to 12 items.

Concerning changes that occurred in each mathematical concept category, the results for each category showed a correct percentage increase in at least one questions. The outcomes of each

category are as follows: “about real number system” an increase 2 out 3 “solving equations, expressions, or inequalities with variables” an increase 4 out of 7 questions, “further on sets” an increase in 3 out of 5 items, and “relation and functions” and increase of 3 out of 4 problems. Overall, concerning improvement with percentages, students performed better on 14 out of 20, which is about 70% of the problems on the post-assessment.

There were two items on the assessment that showed noticeably significant improvement. The most significant percentage increase was seen in item number 2, which received a correct response from 33% (n=26) of students in the pre-assessment, but yielded a correct answer from a remarkable 55% (n=35) of students in the post-test, a 22% increase. The mathematical concept associated with this question was “simplifying radical expression.” Another significant change occurred for the results of item number 6 between the pre- and post-test. This item was originally answered correctly by only 38% (n=30) of students. However, in the post-test 64% (n=40) of students knew the correct answer, which reveals a 26% improvement. Number 6 dealt with understanding how to solve the solution set of linear equation involving absolute value.

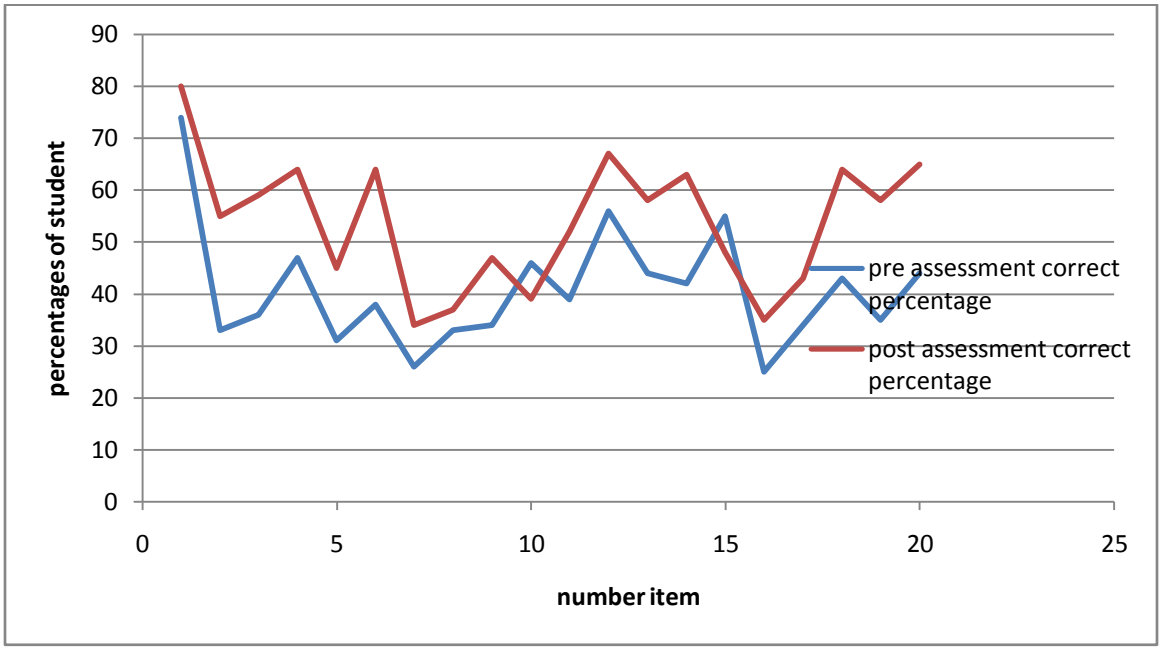

Figure 6. Pre-test vs Post-test Percentages of Students who choose the Correct Answer per Item.

In addition to descriptive analysis, a paired-sample dependent t-test was run in order to statistically compare the data from the pre-assessment and post-assessment. The t-test indicated that there was a statistically significant improvement in performance ability between the pre- and post-assessment for the group of 80 math tutoring students who took both tests. The obtained *p*-value for the dependent t-test was .00, which is less than the .05 alpha levels. Therefore, there is a statistically significant improvement in performance ability in students from the pre-test to the post-test. There was a statistically significant improvement in performance ability as from the time students took the pre-test, (M=8.36, SD=2.00) to the time they took the post-test (M=13.97, SD=2.87). On average, results increased from correctly answering 40% of the assessment items on the pre-test, to correctly answering 70% of the items on the post-test. The results of this study allow for some interesting conclusions in reference to what the future holds for math tutoring programs.

4.6. The Influence of mathematics tutorial program on students' mathematics achievement

The review of research found positive effects for afterschool programs in Texas which combined recreation and academics. The review also found that "programs that add social enrichment to an academic focus...have positive effects on mathematics achievement" (pp. 71–72). For example, in a study of five urban Boys and Girls Clubs of America afterschool programs involving 283 fifth through eighth grade participants (all residents of public housing), positive effects were reported in mathematics achievement for students participating in specific mathematics- and literacy-related activities. These activities included discussion groups that provided opportunities to talk about math, creative writing sessions, home work help, peer tutoring, and recreational activities such as gardening, sports, and cultural events.

Research Question 1

"What are the influences of mathematics tutorial program in improving the academic achievement of lower achiever students?"

Paired t-test utilized to determine if there was a statistically significant different mean score on the pre-test math for lower achiever students who had taken a math tutorial class versus on the students who took post-test. Now two measurements were taken for all participants: pre-achievement, post-achievement, pre-attitude, and post-attitude. The group was comparable as using pre and post test score supported by a comparison of the means from the results of paired t-tests. The scores increased by a mean from 8.36 to 13.97. There is a significance p value of .00 for the pre and post achievement scores difference was indicated.

Table 2. The achievement of low achiever students on math tutorial

Variable	measurement	N	mean	SD	df	t	P

Achievement	Pre-test	80	8.36	2.00	79	46.45	.000
	Post-test	80	13.97	2.87			

As seen in the table 2 there is statistically significant difference between the means of the post test achievement scores of the students and pre-test achievement scores of students. It can be seen that there is a significant difference between the means of the achievements post test scores (13.97) and pre-test scores (8.36) It has been found out that the program (mathematics tutorial program for low achiever students) used with the lower achiever had an effect on the success in the mathematics score according to the research findings.

The data collected by Schacter (2000) also shows that students working with other students increases learning and achievement. Roscoe and Chi (2007) again support the notion that such tutoring programs can have benefits for tutors and tutees, and this is one of the most appealing aspects of peer tutoring: the opportunity to support learning for both the tutees and the tutors. Overall, varied research supports that tutoring programs have substantial benefits. Benefits that are more specific include the fact that "tutoring has a positive impact on a variety of math proficiencies, including arithmetic computation, conceptual understanding, and problem solving skills.

4.3.1. The Influence of mathematics tutorial programs on students' achievement with respect to sex

Most of the researches focused on mean level gender difference, but variability (variance) remains an issue even when means are similar. The greater male variability hypothesis was originally proposed in the 1800s and advocated by the scientist such as Charles Darwin and

Hevelockellis, to explain why there was an excess of men both in homes for the mentally deficient and among geniuses

Table 3. The influence of mathematics tutorial program on female students' achievement

Variable	measurement	N	mean	SD	df	t	P
Female Achievement	Pre-test	52	8.08	1.63	51	1.65	.000
	Post-test	52	13.32	2.68			

As seen by inspection in Table 3, there is a difference between the means of female students achievements post test scores (13.32) and the means of the achievement of the pre-test (8.08). From table 6, there was a significance difference in the pre and post achievement ($p < .05$) that means female students on the pre assessment and on the post assessment differed significantly in their mathematics achievement.

Table 4. The influence of mathematics tutorial program on male students' achievement

Variable	measurement	N	mean	SD	df	t	P
Male Achievement	Pre-test	28	8.64	2.37	27	1.65	.000
	Post-test	28	14.65	2.98			

As seen in table 4 above, the mean achievement of male students on the pre-test is 8.64where as the mean achievement of male students on the post achievement test is 14.65. There is also significance difference in the achievement of male students on the pre-achievement tests score

and on the post achievement score. This corroborates popular research findings in gender literature (Ezeameyi 2002; Asimeng – Boahene 2006).

4.7. The attitude of lower achiever students in mathematics and mathematics tutorial programs

4.7.1. The attitude of lower achiever students in mathematics

Several reasons have been suggested for these negative attitudes including students' undesirable experiences in previous science courses and with instructors, lack of needed skills to learn and apply scientific concepts, lack of motivation to work hard in science classes, home backgrounds, school and classroom environments, biases of peer groups, the media's portrayal of scientists, and students' perceptions of rewards associated with learning, to name a few (Rogers and Ford 1997). Science anxiety, the fear of science learning, and apprehension toward scientists and science-related activities are also results of these factors (Rogers and Ford 1997). As different researcher writes the students' attitude towards mathematics are not good, especially lower achiever students.

Pre survey results

The following results were found for the pre-survey. At least 65% (n=52) of students at least agreed with the statements "Mathematics is a necessary subject for my future success, " "Math teaches me to think more logically," "Mathematics is important to everyday life," and "I am comfortable answering questions in math class." There were also statements that resulted in a 50/50 "split" among responses. In response to the statement "I have a lot of self confidence when it comes to mathematics," students yielded a 41% (n=32) response of at least "Agree" and a 44%

(n=35) response of a combined "Disagree" and "Strongly Disagree." Additionally, the statement "I enjoy studying mathematics class," and "I am never fear in attending mathematics class" resulted in about 40% (n=31) of at least "Agree" responses and about 55% (n=44) of "Disagree" responses. The statement "I believe I am good at solving math problems" also showed a divided response of about 46% (n=37) "Agree" and 42% (n=34) "Disagree."

Concerning the "scattered" responses, defined as those where no one option was chosen as the majority, the item that stated "I really like math" resulted in an array of various answers. About 40% (n=31) answered at least "Agree," 32% (n=26) answered a combined "Disagree" and "Strongly Disagree," and about 21% (n=17) responded with "No Opinion." The item "I believe studying math helps me with problem solving in other areas of my life" yielded somewhat similar results with about 69% (n=55) of students answering with "Agree," about 13% (n=10) answering with "Disagree," and about 18% (n=15) responding with "No Opinion." See *Appendix 3* for more detail.

Table 5. The attitude of lower achiever students in mathematics before tutorial program.

Variable	N	M	SD
Attitude	80	3.65	1.02
Enjoyment	80	3.61	.935
Usefulness	80	3.71	1.68
Confidence	80	3.34	.92

Inspection of the four variables attitude, enjoyment, usefulness and confidence means indicates that they have to some extent positive attitude, enjoyment, usefulness and confidence similarity, the mean of usefulness (3.71) is greater than the mean of confidence (3.34), and the mean of attitude (3.65) and the mean of enjoyment (3.61). Therefore most of students have good attitude on the usefulness of mathematics other than the other variables enjoyment and confidence. And most students have not good attitude on the confidence for mathematics to compare the other variables, enjoyment and usefulness.

Table 6. Descriptive statistics and paired sample t-test for low achiever students' attitude on mathematics and its components with respect to sex.

Variable	Sex	N	M	SD	df	t	p
Attitude	Male	28	3.78	.843	79	1.96	.004
	female	52	3.55	.795			
Enjoyment	Male	28	3.77	.841	79	.963	.002
	female	52	3.53	.793			
Usefulness	Male	28	3.67	.913	79	2.02	.001
	female	52	3.47	1.11			
Confidence	Male	28	3.71	.889	79	2.22	.000
	female	52	3.44	.941			

As is seen a table 6 there is significant mean difference of the variables on male and female survey results like attitude, confidence, usefulness and enjoyment was addressed by conducting a paired sample t-test. From the table for all variables such as attitude, enjoyment, usefulness and confidence in mathematics of male students are higher positive perception than the female students. That is, there is a significance difference between male and female low achiever students for all variables.

4.8. The attitude of lower achiever students in mathematics tutorial program

Post survey of students' attitude towards mathematics tutorial program

A post-survey was administered approximately four months after the initial pre-survey was given to students. In reference to the second research question, "Does the program impact students' attitudes toward mathematics tutorial program?" In reference to question, "Does the program impact students' attitudes toward math tutoring?" the post-survey revealed that students responded with an answer of at "Strongly Agree" or "Agree" to 24 out of 25 math-tutoring-related statements on the post-survey. At least 78.8% (n=63) of students concurred that they enjoy going to math tutoring, I am never fear in attending tutorial class, agree that math tutoring helps them realize that math tutoring is important to improve their achievement, believe that math tutorial class is useful for my change of my mathematics result, I am beneficiary by attending tutorial class, I will get good mark in my mathematics result after tutorial class, it will important attending tutorial class, I like to do mathematics question which will be solve using different methods on tutorial class, tutorial class will make me medium learner, tutorial class will support students to solve different mathematics problems, tutorial class will recognize and correct errors by themselves, tutorial will made a strong effort to students, mathematics is hard for me, but by attending tutorial class I will improve," "doing mathematical tasks help me to creative," "attending tutorial is difficult for me due to my personal reason," Additionally, at least 78.8% of students (n=63) responded positively to these math-related survey statements as well: " I will not good at mathematics tutorial class," "I don't feel of good attending tutorial class," "for only low achievers are attending tutorial class, I don't feel good," "I don't believe that my result is improved," " tutorial class has no use," "attending math tutorial class is a waste of time," math tutoring helps them to focus better in their regular class. There was only one statement that showed a "split" among responses. In response to the sentence "Math tutoring helps me to enjoy

studying math in school," 11.1% (n=7) chose "Strongly Disagree", 40.8% (n=26) responded with "Agree", 25.2% (n=16) yielded an answer of "Strongly Agree", and 21.9% (n=14) answered "No opinion."

Table 7. The attitude of lower achiever students in mathematics tutorial program

Variable	N	M	SD
Attitude	80	3.75	1.22
Enjoyment	80	3.61	.995
Usefulness	80	3.81	1.68
Confidence	80	3.43	.927
Success	80	3.43	1.82

Inspection of the five variables, such as attitude, enjoyment, usefulness, confidence and success means indicates that they have to some extent positive attitude, enjoyment, usefulness, confidence and success similarity. The mean of usefulness (3.81) is greater than the mean of confidence (3.44), and the mean of attitude (3.75) and the mean of enjoyment (3.61). Therefore most of students have good attitude of the success on the mathematics tutorial program other than the other variables enjoyment, confidence and usefulness. To the other side most students have not good attitude of confidence on mathematics tutorial program other than the other variables usefulness, enjoyment and success.

Table 8. Descriptive statistics and paired sample t-test for low achiever students' attitudes on tutorial program and its components with respect to sex.

Variable	sex	N	M	SD	df	t	p

	Male	28	4.00	.608	79	.012	.002
Attitude	female	52	3.56	1 .15			
	Male	28	4.00	.8516	79	.862	.000
Enjoyment	female	52	3.53	.793			
	Male	28	3.87	.913	79	2.02	.001
Usefulness	female	52	3.72	.783			
	Male	28	3.87	.923	79	2.12	.000
Confidence	female	52	3.67	1.14			
Success	male	28	3.86	.943	79	2.22	.000
	female	52	3.87	1.15			

As is seen a table 8 there is significant mean difference of the variables on male and female survey results like attitude, confidence, usefulness, success and enjoyment was addressed by conducting a independent sample t-test. From the table for all variables such as attitude, enjoyment, usefulness, success and confidence in mathematics tutorial program of male students are higher positive perception than the female students. Most male students have good attitude of enjoyment on mathematics tutorial program to compare the other variables, whereas most female students have good attitude of success on mathematics tutorial program to compare the other variables. And most male students have not good attitude of success on mathematics tutorial program to compare the other variables, and most of female students have not good attitude of enjoyment on mathematics tutorial program to compare the other variables And $P > .05$ so that there is a significance difference between male and female low achiever students for all variables.

4.9. Impact of attitude and component attitude on mathematics achievement

Research question 3:

"Is there a significant impact of the attitude and component of attitudes on the achievement in mathematics?" Research Question 3, which asked if there was a difference in student performance based on participation in the mathematics tutorial class and the attitude of students, was addressed by conducting a Regression analysis. For this analysis, the dependent variable was the achievement of students, the independent variable was the attitude of students i.e confidence, enjoyment and usefulness.. This analysis was important to ascertain if there was a statistically significant difference in the attitude for the population of ninth grade students.

Table 9: ANOVA table that shows the impact of confidence, enjoyment, and usefulness of students' mathematics achievement

Model	Sum of Squares	df	Mean square	F	Sig.
Regression	4049.187	3	82.636	43.324	.000
Residual	5320.308	75	19.232		
Total	9369.495	78			

Multiple R=.832 , R^2=.780

a. Dependent variable: achievement

b. Predictors: (constant), confidence, enjoyment, usefulness

In the ANOVA table 9, F value indicates that the multiple correlations R were significant for mathematics achievement that is the contribution of the variables confidence, usefulness and enjoyment from mathematics tutorial program collectively significant affected the achievement of students' mathematics.

Table 10: t-table shows individual impact of usefulness, enjoyment and confidence from mathematics tutorial on mathematics achievement

Variables	r	B	Std. Error	Beta	T	Sig.

Usefulness	.831*	8.441	.539	.456	11.67	.000
Enjoyment	.798*	7.231	.521	.318	12.02	.000
Confidence	-.486*	-.250	.480	-.255	-9.522	.000

In table 10, t-values indicate that the attitude i.e usefulness, enjoyment and confidence in mathematics tutorial program were significantly affected the mathematics achievement. From regression table 9, since R^2=0.780 then the three variables (usefulness, enjoyment and confidence in mathematics tutorial program) had 78% effect or contribution on mathematics achievement. The percent of effect or contribution of each component of usefulness, enjoyment and confidence in mathematics tutorial program on achievement of students in mathematics can be found by $R^2= (\beta_c r_c+\beta_e r_e+\beta_u r_u)*100\%$.that is, 78% ≈39%+26%+13%. Therefore the contribution of usefulness of mathematics tutorial program enhanced the achievement of mathematics by 39%, the contribution of enjoyment of mathematics tutorial program enhanced the achievement of mathematics by 26% and the contribution of confidence of the mathematics tutorial program enhanced the achievement of mathematics by 13%.

CHAPTER FIVE

5. SUMMARY AND CONCLUSIONS

5.1. Summary

Identified in chapter one as a core subject, math is regarded as the "bedrock of our modern world" and it is of crucial importance that students are successfully taught to understand the concepts that lie within math, as the skills involved are an integral part of our society (Roman, 2004). Knowledge of mathematical concepts is one of the all-important skills needed in order to function in most parts of society. Many may not realize that math is the tool that we use to make sense of our world in numbers. Not only are math skills needed for simple functions such as calculating purchase totals and being able to read graphs to understand trends and patterns, but math is also an integral part of science as well. Many of the sciences (i.e. physical sciences, chemistry) require proficiency in math, and the background knowledge associated with the sciences can be used for everyday problem-solving. While many students tend to rule out a career in the math or science fields, they may be more inclined to pursue them if they had a strong foundation in basic mathematics. Previous research supports that tutoring programs similar to the one installed at Atse Naod High School have resulted in more positive student attitudes in classrooms with tutoring programs, and more favorable self-concepts for students in classrooms with tutoring programs. Overall, tutoring has earned an agreeable record, one of which this study provides further evidence.

5.2. Conclusion

The fundamental aim of this study was to investigate the effects of mathematics tutorial program on the attitude and achievements of lower achiever students. It was revealed that the findings

obtained from the results of the pre and post tests administered at the end of the mathematics tutorial program revealed that there was a significant difference between the attitude and achievements post test scores corrected according to the pre test students. The individual achievement scores from the 20-item test based on pre- and post-test outcomes were higher on the post-test achievement.

Independent sample t-tests provided a comparison of the means of the pre and post achievement scores and attitudes were followed by repeated measures multivariate analysis of variance ANOVA, which revealed significant main effects. Therefore, two separate repeated measures ANOVA were conducted using achievement and attitude as the dependent variables. There were two measures taken on achievement: pre-achievement and post-achievement and pre-post measures on attitude were taken for all participants. Interaction effects of pre-tests, post tests, and group were highly significant with an F statistic of 11.27 and p-value of .000.

Overall, there was a noticeable positive change between the Pre vs Post-survey and assessment findings. According to the pre- and post-surveys, a substantial change occurred where there was a positive change in the attitude of the students toward math in general, as well as towards math tutoring. Eighty lower achiever students took it; the results for the post-survey were even more positive then the pre-survey outcomes. Students' positive attitudes on the post-survey may be attributed to the fact that of low achiever students who took the post-survey were students who had continuously participated in the math tutoring program throughout the tutoring session.

In regards to the post-assessment versus the pre-assessment results, there was also a change that represented positive outcomes. Again, the students who took the post-test represented the population of tutees who continued to attend math tutoring. The literature supports this idea of

positive outcomes resulting from of peer tutoring including descriptions of how it has "definite and positive effects on the academic performance and attitudes of those who receive tutoring" (Cohen et al., 1982, p. 244). The mentioned definite and positive effects on the academic performance of tutees involved in tutoring are true for the pre-assessment scores compared to the post-assessment scores.

In addition to the positive outcomes, some unusual outcomes were discovered through the post-test as well. A few of the students' post-assessment scores actually decreased from their pre-test scores. The more interesting aspect of this fact is that the students whose scores decreased were those who continued participation in the program. This could have resulted from a number of factors. The students could have guessed on each of these tests, producing responses that were not truly reflective of their mathematical abilities. Moreover, those particular students could have been lacking in their knowledge of the content on the assessment when they first completed it and the content was not addressed in their math class during the school year. As a result, students may have forgotten the content and may have even forgotten how to answer the questions. Furthermore, another inference as to why students performed poorly on the pre- and post-assessment is the timing of the post-assessment. The post-assessment was given to students at the end of the school year, a time where many of them have mentally "checked out." Many of them may have been mentally exhausted and, in turn, were not willing to put forth the effort to performing their best on the assessment. Although the average scores of the pre- and post-assessments were not ideal, as mentioned throughout chapter four, there were noticeable positive shifts in the math concept categories. The shifts serve as evidence that some type of learning took place in participants from the pre- to post-assessment. Though all the reasons behind

student performance trends cannot be accounted for in this study, there are many possible answers.

5.3. Implications

The findings of the study have revealed a number of meaningful positive outcomes and results that support the implementation of future tutoring programs. In regard to the research questions of this study, each one was answered as part of the outcome of the study.

The results can especially be used as evidence for other schools contemplating the installation of a math tutoring program. However, the quantitative data is a vital factor and serves as crucial supporting evidence. Math teachers at Atse Naod High School should find the data from this study extremely beneficial for application to their teaching. Math teachers at Atse Naod High School should process the information from the attitudinal surveys and use it as evidence to support the fact that the math tutoring program can be and was helpful to many students who continued participation throughout the school year. In addition, taking into consideration the explanations of results from the post-assessment, teachers should make a point to integrate review of basic mathematical concepts into their instructions so that the skills remain fresh in students' minds.

As a result of the analyses conducted in this study, evidence of a positive outcome exists. Although the change in performance for the assessments was not statistically significant difference, the improvement in specific math concepts and attitudinal survey data is important and useful. Additionally, as a result of the outcomes, an opportunity for greater learning has been opened. The students who participated in the study will likely be more willing to learn about math since their attitudes toward it have changed for the better. The post-assessment and post-survey have both produced outcomes that show positive changes in students' attitudes toward

math and math tutoring, as well as in their performance in math. Those data suggest that future research should be aimed at varying demographics for the purposes of either supporting or refuting the findings in this and other similar studies. This researcher hopes that careful analysis is taken in the future by those individuals not only for the purpose of tutorial for low achiever students, but for the success of students overall.

5.4. Recommendations

Schools have an obligation to provide all students with high-quality mathematics instruction. Each student learns differently and has different strengths and weaknesses in regards to their learning needs. Collecting data on all mathematics students helps educators make solid, data-based decisions. Universal screening and progress monitoring assessments can help guide educator's mathematics instruction and student servicing. When individual student needs have been identified, quality core mathematics instruction using differentiated instruction, flexible student groupings, and team teaching needs to take place. Teaching the basic mathematics facts to a mastery level is a crucial part of any mathematics tutorial program. Increasing active student engagement and incorporating scaffolding techniques helps increase student learning. Using an instructional sequence that moves from concrete instruction to representational instruction to abstract instruction is effective and highly recommended. When students are not making adequate progress with the core curriculum, tutorial program should be used to provide additional, instruction. Using good instructional techniques and individualized intervention while monitoring student progress helps educators make future instructional decisions, correct deficit areas, and produce growth in mathematics learning.

Reference

Alliance for Excellent Education,(2003), students who lack the social skills and motivation can begin school at a disadvantage.

Alspaugh, 1998; Irvin, 1997; Barone, Aquirre-Deandreis, & Trickett, 1991; Reyes, Gillock, &

Kobus,1994; Roderick, 1993; Felner et al., 1993; Seidman, Aber, Allen, & French, 1996.

Arnett, J. J. (2007). *Adolescence and emerging adulthood (3rd Edition)*. Upper Saddle River.

Baker &Witt, 1996; Foley, Eddins , & Fenton , 2000; Grossman et al. 2002 ;Huang, Gribbons,Kim ,lee & Baker ,2000.

Benard, 1999; Kalkowski, 1995; Martino, 1993; Miller et al, 1993; Topping, 198 implementing tutorials will promote student engagement and improve academic skills.

Bloom, 1984, tutoring has been extremely effective intervention .

Bowling Green State University GEAR UP (2010). *Bowling green state university gear up measures and indicators*.

Cavanagh, S. (2009). Some urban districts exhibit progress on math assessment. *Education Week*, *29* (15), 6.

Carmichael, C. & Taylor, J. A. (2005). Analysis of student beliefs in a tertiary preparatory mathematics course. *International Journal of Mathematical Education in Science and Technology, 36*(7), 713-719.doi:10.1080/00207390500271065

Cherif and Wideen 1992; Garcia and McFeeley 1978, There is growing evidence that students who possess positive attitudes toward science will perform better academically.

Chen, J. & McNamee, G. (2006). Strengthening early childhood teacher preparation: Integrating assessment, curriculum development and instructional practice in student teaching.

Cohen, P. A., Kulik, J. A., & Kulik, C. C. (1982). Educational outcomes of tutoring: A meta analysis of findings. *American Educational Research Journal*, *19*(2), 237- 248.

Cole, C. (2008). *Ten weeks of academic intervention designed to improve math word problem solving among middle school student: Effects of a randomized pilot study* (Doctoral dissertation).Retrieved from Education Research Complete database.

Cook, L. L. (2008). *Increasing middle grades math achievement through effective teaching practices* (Doctoral dissertation). Retrieved from ProQuest. (ProQuest Document ID 304386874).

Cohen, et al, 1982; Kalkowski, 1995; Martino, 1993, Tutoring contributes to improvement in Cohen , Kulik, & kulik 1982; lapper, Drake, & Odonne 11-Johnson, 1997; McArthur,Lewis, & Landers, 1995,. tutoring works sometimes and under certain conditions.

Cooledge & Wurster, 1985; Wasik & Slavin, 1990; Wilks & Clarke, 1988; Academic delivery can take many forms including using tutors to provide more instruction students Attitudes

about school, which in turn reduces dropout rates, truancies, and tardies.

Cosden (2001) described after school programs as a "safety net" for disadvantaged children, and Miller (2003) and Welsh (2002) found that tutoring programs provide the individualized

help students need to achieve academically.

Creswell, J. W. (2005). *Educational research second edition.* Upper Saddle River: Pearson Education Dependent t-test for paired samples. *Scientific Method Understanding Science, Research and Experiments*.

Elliot,(2000), tutorial program as a special instruction designed to help students catch up a desired level of academic achievement.

Flaxman, 1992; Jekielek, Moore, Hair & Scarupa, 2002), these approaches will often designed to change student attitudes, motivation or beliefs about school.

Frye ,(2010) ,further discussed motivation strategies that can work with middle school students.

Goldman ,N Heney ,w, and Kofier et ,al .cited by Hijazi syed Tahier and Naquir Rosa ,2006;1The link between students achievement, economic circumstances and the risk of being a dropout is provided to be positive.

Holloway, J. H. (2004). Closing the minority achievement gap in math. *Educational Leadership*, *61*(5), 84-86.

Jenkins and Jenkins (1987) cited by Kalkowski(2001) write ,tutoring instruction (parents teaching their offspring how to make a fire and to hunt and adolescents instructing younger siblings about edible, berries and roots.

John Schacter (2000) also shows that students working with other students increases learning and achievement.

Kavale & Forness, 2001, tutorial focused on improving academic skills are more effective than tutorial attempting to improve cognitive process.

Kajander (2010) found that some teachers had a weak knowledge of material.

Lalley, Miller(2006; 11).

Martino, 1993, tutoring provides emotional support and positive role models.

McConney and Perry (2010) Brown, S. (2010). *An evaluation of an extended learning opportunity in mathematics and reading for targeted at-risk middle school students* (Doctoral dissertation).

Mitchell, T. (1999). Changing student attitudes towards mathematics. *Primary Educator*, *5*(4), 2-8. Ohio Department of Education (2009). Academic Content Standards Feedback .

Powell (1997;11) , the tutoring is especially beneficial among disadvantaged students.

Robinson (2005), The practice of students teaching other students has a history that dates all the way back to the ancient Greeks .

Roderick & Camburn, 1999; Blyth, Simmons, & Carlton-Ford, 1993. NJ: Prentice Hall.

Roman, H. T. (2004). Why math is so important. *Tech Directions*, *63*(10), 16-18.

Roscoe, R. D., & Chi, M. T. (2007). Understanding tutor learning: Knowledge-building and

knowledge-telling in peer tutors' explanations and questions. *Review of Educational Research*, *77*(4), 534-574.

Saffer, N. (1999, Summer). Core subjects and your career. *Occupational Outlook Quarterly*, *43*, 26-40.

Schacter, J. (2000). Does individual tutoring produce optimal learning?. *American Educational Research Journal*, *37*(3), 801-829.

Teshome 2002 , School related factors includes the working environment, distance to school, teachers altitude and teaching practice, gender bias in curricula and class room culture.

Topping , et al, 2003; Valeski & Stipek, 2001, affecting changes in mathematical performance, the interaction during tutorials can impact students attitudes toward learning.

Topping, 1998; Stipek,(2001), Research studies have been shown to link tutoring with achievement, performance, and attitudes .

Torstein,Husen (1995), organized and wide spread use of tutoring is credited by a Scots man called Andrew Bell.

Walker, 2007, Though there has been a considerable amount of research done concerning tutoring programs, those dealing with underserved high school students such are not as well documented.

Weber (2008) noted in a study of a female student who did not become interested in math until she understood the course material better.

Appendix 1

Math and math tutorial attitude survey

Student questionnaire

Dear students

- ✓ **This study is conducted for the fulfillment of MA thesis in mathematics education. The main purpose of the study is to investigate the effectiveness of tutorial program provided for lower achiever students of grade 9th .Students are among those chosen to participate in the study. Thus the researcher cordially requests you for information and appreciates you genuine willingness to provide the necessary information for the purpose of the study . Mean while, I assure you that, all the information obtained from respondents will be used only for the purpose of this research.**

Thank you:

Personal Data

1. **Name of your school ----------sub-city----------**
2. **Sex---------- age----------Grade----------**
3. **Your first semester mathematics result----------**

- ✓ **Instruction for both part one and part two; As you read the sentences, you will know whether you agree or disagree. If you strongly agree, tick ( ) strongly disagree (SA) .If you agree ,but not strongly ,tick ( ) Agree (A) .If you are not sure about a question or you can't answer ,tick ( )**

Undecided (U) . If you disagree with the sentence about not strongly, tick ( ) disagree (DA) ,If you disagree with the sentence very much tick ( ) strongly disagree.

Part 1 - The altitude of students towards mathematics tutorial class

No	Altitude of students towards mathematics tutorial class	SA	A	U	D	SD
1	I enjoy by attending tutorial class					
2	I am never fear in attending tutorial class					

3	**I can improve my performance by attending tutorial class**					
4	**I believe tutorial class is useful for my change of my mathematics result**					
5	**Mathematics is hard for me ,but by attending mathematics tutorial class I will get improvement**					
6	**I am beneficiary by attending tutorial class**					
7	**I can get good mark in my mathematics result after tutorial class**					
8	**It is important attending tutorial class**					
9	**I haven't improved my result through I attending tutorial class**					
10	**I am not good at mathematics tutorial class**					
11	**Attending mathematics tutorial class is a west of time**					
12	**I don't feel of good attending tutorial class**					
13	**I don't believe that my result will be improved**					
14	**For only low achievers are attending tutorial class, I don't feel good**					
15	**Attending tutorial class is difficult for me due to my personal reason**					
16	**I couldn't stay for extra tutorial class in school for I am helping myself outside the school**					
17	**Tutorial class has no use**					
18	**I like to do mathematics questions which could be solved**					

	using different methods on tutorial class					
19	**Doing mathematical tasks help me to be creative on the tutorial class**					
20	**Tutorial class made me medium learner**					
21	**Math tutoring helps them to focus better in their regular class**					
22	**Math tutoring helps me to enjoy studying math in school**					
23	**It recognize and correct errors by themselves**					
24	**Tutees made a strong effort for students**					
25	**Tutorial class support students to solve different mathematics problems**					

1. **What do you think about the tutorial program?**

   _____

   _____

   _____.

2. **Are there any criteria that used to recruit lower achiever students for the program?**

   YES ☐ **NO** ☐

3. **If your answer for question number 2 is yes, what are the criteria?**

- **Low level parental income** ☐
- **Being a lower achiever** ☐
- **No criteria** ☐

☐
☐
☐
☐
☐

- **Specify if any----------**

4. Who is recruiting lower achiever for the tutorial program?

- **Teachers**
- **Students**
- **School administrator**
- **Parents**
- **Parent teacher union**
- **Specify if any----------**

5. How often you come to the tutorial program?

- **All times** ☐
- **Seldom** ☐
- **Frequently** ☐

6. How do you see the similarity/differences between the tutorial session and the formal class?

- **Very similar** ☐
- **Fairly similar** ☐
- **Dissimilar** ☐
- **No sure** ☐

7. Are you happy of attending tutorial class?

YES ☐ **NO** ☐

If your answer is YES what made you happy of the tutorial program?

If your answer is NO what are your reason?

---

8. Are you beneficial of attending tutorial class?

YES **NO**

9. Is your performance and mathematics result improved after attending tutorial class?

YES **NO**

Part 2 –attitude of students towards mathematics

Item	STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
Math is important to everyday life.					
Math is a necessary subject for my future success.					
I will get a great deal of satisfaction out of correctly solving a math problem.					
Math teaches me to think more logically.					
I am comfortable answering questions in math class.					
I believe studying math helps me with problem-solving in other areas of my life.					
I believe I am good at solving math problems.					
I really like math.					

I have a lot of self-confidence when it comes to math.					
I have usually enjoyed studying math in school.					

Appendix 2

PRE- AND POST-ASSESSMENT

Name_____

Grade_____ date_____

Direction: Clearly circle the letter of the answer you believe to the correct answers.

1. The GCF of two numbers is 3 and the LCM is 180. If one of the numbers is 45, what is the other number?

a) 15 b) 12 c) 9 d) 18

2. The simplification form of $8\sqrt{24}+2\sqrt{54}-2\sqrt{96}$ is?

a) $14\sqrt{6}$ b) $16\sqrt{6}$ c) 2 d) $8\sqrt{2}$

3. The rationalizing factor of $5/1-2\sqrt{2}$ is?

a) $1+\sqrt{2}$ b) $1-\sqrt{2}$ c) $1+2\sqrt{2}$ d) $1-2\sqrt{2}$

4. The solution set of $-2(8+4x) = 4(-2x+1)$ is?

a) 2 b) 5 c) 0 d) {}

5. The solution set of $7x+5y = 11$

$-3x+3y = -3$ is?

a) (2,3) b) (4/3,1/3) c) (4/5,1/3) d) (1/3,4/3)

6. Determine the value of x, when $|3x+2| = |2x-1|$

a) {-3,-1/5} b) {3, 1/4} c) {2/3, 4/5} d) {}

7. If one of the roots of the equation $x^2-4x+k = 0$ exceeds the other by 2, then find the value k?

a) 0 b) 1 c) 2 d) 3

8. Two different squares have a total area of 274 cm^2 and the sum of their perimeters is 88 cm. find the lengths of the sides of the smaller square.

a) 15 cm b) 6 cm c) 8 cm d) 7 cm

9. Determine the value of x when $-2(1/2x+5) \leq 0$.

a) $x \geq 0$ b) $x \leq 0$ c) $x > 0$ d) $x < 0$

10. The solution set of $3x+4 > 2(-2x-7)$ is?

a) $x \geq -14/7$ b) $x \leq -14/7$ c) $x > -14/7$ d) $x < -14/7$

11. Which of the following sets have finite number of elements?

a) $A=\{x \mid x \in R \text{ and } 0 < x < 3\}$

b) $B=\{x \in N \mid 7 < x < 7^{100}\}$

c) $C=\{x \in N \mid x \text{ is a multiple of } 3\}$

d) $D=\{x \in N \mid x \text{ is divisible by 5 and } x > 100\}$

12. Let B = {0, 2, {4, 5}, 8}, then what is the number of proper sub sets of set B?

a) 16 b) 20 c) 17 d) 15

13. Which of the following pairs represent equal sets?

a) {a, b} and {2,4} b) {1,{2,4}} and {1,2,4}

c) $\{x \in N \mid x < 5\}$ and {2, 3, 4, 5} d) $\{x \mid x < x\}$ and $\{x \in N \mid x < 1\}$

14. Let U={1,2,3,4,5,6,7,8,9} be the universal set and A={1,2,3,4}, B={2,4,6,8} then (Au B)' is?

a) {5,7,8,9} b) {5,7} c) {1,2,4,7} d) {}

15. If (2x + 3, 7) = (7, 3y + 1), find the value of x and y.

a) x=3 and y=2 b) x=2 and y=3 c) x=2 and y=2 d) x=1 and y=3

16. In a class of 31 students, 22 students study physics, 20 students study chemistry, and 5 students study neither. Calculate the number of students who study both subjects?

a) 18 b) 14 c) 12 d) 16

17. The domain of Relation $R = \{(x, y): y \geq x+2 \text{ and } y > -x; x \in R \text{ and } y \in R\}$ is?

a) $\{x \in R: x > 0\}$ b) $\{x \in R: x < 0\}$ c) $\{x: x \in R\}$ d) $\{x \in R: x > 1/2\}$

18. Let f(x)=x-1 and g(x)=3x. Determine (2f+3g)(1).

a) 9 b) 8 c) -1 d) 0

19. Determine the maximum value of the function $f(x) = -x^2+6x-8$.

a) 1 b) 2 c) 4 d) -3

20. Which of the following is increasing function?

a) f(x)= -3x+1 b) x + y=1-3x c) 3x-2=2y d) f(x) -7=2

APPENDIX 3

PRE-SURVEY MATH PERCENTAGES

Item	STRONGLY DISAGREE	DISAGREE	NO OPINION	AGREE	STRONGLY AGREE
Math is important to everyday life.	3% (n=2)	12% (n=10)	5% (n=4)	45% (n=36)	35% (n=28)
Math is a necessary subject for my future success.	3% (n=2)	8% (n=6)	4%(n=3)	48.1% (n=38)	40.9% (n=33)
I get a great deal of satisfaction out of correctly solving a math problem.	0% (n=0)	11% (n=3)	4% (n=18)	65% (n=5)	20% (n=1)
Math teaches me to think more logically.	0% (n=0)	9% (n=7)	10% (n=8)	70% (n=56)	11% (n=9)
I am comfortable answering questions in math class.	3% (n=2)	15% (n=12)	7% (n=7)	45% (n=36)	29% (n=23)
I believe studying math helps me with problem-	0% (n=0)	13% (n=10)	18% (n=15)	69% (n=55)	0% (n=0)

solving in other areas of my life.					
I believe I am good at solving math problems.	0% (n=0)	42% (n=34)	9% (n=7)	46% (n=37)	3% (n=2)
I really like math.	14.6% (n=11)	18.4% (n=15)	21% (n=17)	40% (n=31)	7% (n=6)
I have a lot of self-confidence when it comes to math.	7% (n=6)	40% (n=32)	9% (n=7)	37% (n=30)	7% (n=6)
I have usually enjoyed studying math in school.	18% (n=14)	37% (n=30)	4% (n=3)	33.3% (n=27)	7% (n=6)

APPENDIX 4

POST-SURVEY MATH TUTORING PERCENTAGES

No	Altitude of students towards mathematics tutorial class	STRONGLY DISAGREE	DISAGREE	UNDECIDED	AGREE	STRONGLY AGREE
1	I enjoy by attending tutorial class	0%(n=0)	0%(n=0)	0%(n=0)	62%(n=39)	38%(n=24)
2	I am never fear in attending tutorial class	0% (n=0)	3.14% (n=2)	0% (n=0)	73% (n=46)	23.8% (n=15)
3	I can improve my performance by attending tutorial class	0% (n=0)	0% (n=0)	0% (n=0)	55.55% (n=35)	44.44% (n=28)
4	I believe tutorial class is useful for my change of my mathematics result	0% (n=0)	4.76% (n=3)	0% (n=0)	53.96% (n=34)	41.26% (n=26)
5	Mathematics is hard for me ,but by attending mathematics tutorial class I will get improvement	0% (n=0)	0% (n=0)	0% (n=0)	55.55% (n=35)	44.44% (n=28)
6	I am beneficiary by attending tutorial class	0% (n=0)	4.76% (n=3)	0% (n=0)	53.96% (n=34)	41.26% (n=26)
7	I got good result after	0% (n=0)	4.76% (n=3)	0% (n=0)	57.14%	38.09%

	tutorial class				(n=36)	(n=24)
8	It is important attending tutorial class	0% (n=0)	3.17% (n=2)	3.17% (n=2)	60.31% (n=38)	33.33% (n=21)
9	I believe that my result improved by attending tutorial class	0% (n=0)	4.76% (n=3)	0% (n=0)	53.96% (n=34)	41.26% (n=26)
10	I will not good at mathematics tutorial class	25.39% (n=16)	71.4% (n=45)	0% (n=0)	3.17% (n=2)	0% (n=0)
11	Attending mathematics tutorial class is a west of time	20.63%(n=13)	52.38%(n=33)	7%(n=6)	17.46%(n=11)	0%(n=0)
12	I don't feel of good attending tutorial class	25.39% (n=16)	71.4% (n=45)	0% (n=0)	3.17% (n=2)	0% (n=0)
13	I don't believe that my result will be improved	35% (n=22)	65% (n=41)	0% (n=0)	0% (n=0)	0% (n=0)
14	For only low achievers are attending tutorial class, I don't feel good	0% (n=0)	3.17% (n=2)	3.17% (n=2)	60.31% (n=38)	33.33% (n=21)

15	Attending tutorial class is difficult for me due to my personal reason	20.63%(n=13)	52.38%(n=33)	7%(n=6)	17.46%(n=11)	0%(n=0)
16	I couldn't stay for extra tutorial class in school for I am helping myself outside the school	20.63%(n=13)	52.38%(n=33)	7%(n=6)	17.46%(n=11)	0%(n=0)
17	Tutorial class has no use	17.46% (n=11)	76.14% (n=48)	4.76% (n=3)	1.58% (n=1)	0% (n=0)
18	I like to do mathematics questions which could be solved using different methods on tutorial class	0% (n=0)	4.76% (n=3)	0% (n=0)	53.96% (n=34)	41.26% (n=26)
19	Doing mathematical tasks help me to be creative on the tutorial class	0% (n=0)	4.76% (n=3)	0% (n=0)	76.14% (n=48)	19.04% (n=12)
20	Tutorial class will make me medium learner	0% (n=0)	3.17% (n=2)	3.17% (n=2)	77.77% (n=49)	15.87% (n=10)
21	Math tutoring helps me to enjoy studying math in school	0% (n=0)	4.76% (n=3)	0% (n=0)	76.14% (n=48)	19.04% (n=12)

22	Math tutoring helps to them to focus better in their regular class	0% (n=0)	3.17% (n=2)	6.34% (n=4)	76.14% (n=48)	14.28% (n=9)
23	It recognize and correct errors by themselves	0% (n=0)	3.17% (n=2)	6.34% (n=4)	74.6% (n=47)	15.87% (n=10)
24	Tutees will make a strong effort for students	0% (n=0)	0% (n=0)	3.17% (n=2)	87.3% (n=55)	25.39% (n=16)
25	Tutorial class will support students to solve different mathematics problem	0% (n=0)	3.17% (n=2)	0% (n=0)	79.36% (n=50)	17.46% (n=11)