

**ADDIS ABABA UNIVERSITY
COLLEGE OF EDUCATION
SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF PSYCHOLOGY**

**THE RELATIONSHIP AMONG PERCEPTION OF
MATHEMATICS CLASSROOM ENVIRONMENT,
INTRINSIC MOTIVATION, AND ACADEMIC
ACHIEVEMENT: The Case of First Year Students in Faculty
of Science, Addis Ababa University**

NEGASI HAGOS TEKOLA



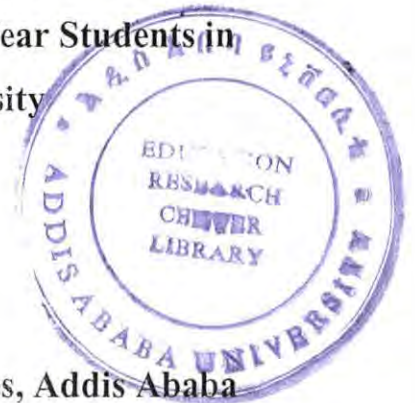
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**MAY 2009
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Faculty of Science, Addis Ababa University



**A Thesis Submitted to the School of Graduate Studies, Addis Ababa
University, in Partial Fulfillment of the Requirement for Master of Arts
in Measurement and Evaluation**

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ABSTRACT

The objective of this study was to investigate the relationship among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement in the course Calculus-I for first year students in the Faculty of Science, Addis Ababa University. The study employed survey methodology to obtain the self-reports of 248 first year students of the departments of computer science, statistics, and earth science who were selected using stratified random sampling technique. The data were collected using perception of mathematics classroom environment questionnaire and mathematics intrinsic motivation inventory which were developed for the purpose of this study. Mathematics grades of the participants for the course Calculus-I were also obtained from official records. Descriptive statistics, correlation, multiple regression analysis, and step-wise regression analysis were used with the help of SPSS 15 to analyze the data. There were positive and significant relationships among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement for science first year students. Among the factors of perception of mathematics classroom environment, student engagement was the best predictor of mathematics intrinsic motivation and mathematics achievement. Significant gender differences in mean scores of perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement were found for science first year students in favor of males. Analysis at department level has revealed significant gender differences in mean scores of perception of mathematics classroom environment and mathematics intrinsic motivation for computer science first year students in favor of males. In each of statistics and earth science departments male and female first year students perceived their mathematics classroom environment similarly and had similar level of mathematics intrinsic motivation. Significant gender differences in mean mathematics achievement score were found in the three departments separately. Based on the results some recommendations are forwarded.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Students' perception of classroom environment is the feeling, belief, or image students have about the classroom environment while they are learning. It is the awareness of students for their activities, interactions, the amount of help and information they obtain from their instructor and their involvement in the classroom learning process. This is very important to achieve the goals of learning.

It is important to note that theoretical and empirical work on this area focus on students' perceptions of mathematics classroom environment (i.e., the psychological environment) rather than the physical environment itself, because it is students' perception that is presumed to play the more important role in motivating the students thereby learning and achieving better. For classroom practitioners and theorists interested in pedagogy, it would seem obvious that psychosocial environment has the potential to influence many outcome variables (Dorman et al., 2002).

Students' perception of classroom environment may have several dimensions. Teacher-student relationships explained by their connectedness, teacher support and communication skills, and students' engagement in the classroom activities are some of the dimensions of the students' perception of classroom environment which are the main interest in this study. The underlying assumption here is that influences on these dimensions as perceived by students influence their perception of classroom environment.

Most studies investigating classroom goal structure have used students' perception of classroom environment theorizing that student perceptions affect their cognition, affect, and behavior (e.g., Ames & Archer, 1988; Ryan et al., 1998). Fry and Coe (1980) found substantial relationships between students' perception of classroom environment dimensions and student self-reports of academic motivation factors. A wealth of evidence now exists

regarding the importance of students' perception of classroom environment for their motivation and learning (Bong, 2005).

Educators and theorists agree that learning involves the active process of integrating and organizing new information, constructing meaning, and monitoring comprehension in order to develop a sound understanding of subject matter (Meece et al., 1988). This implies that the students' positive perceptions of mathematics classroom environment may help first year students to easily adjust themselves to the new environment and achieve their learning objectives.

Research indicates that academic achievement and student behavior are influenced by the quality of teacher-student relationships (Jones & Jones, 2001 in Burden, 2003, p. 92). A secure and close relationship between a teacher and a student may help the student to easily approach, ask help, and to freely engage in class activities. In a study of perceived teacher support of students' questioning in the college classrooms, Karabenick and Sharma (1994) found that students who perceived greater support also reported being more motivated and active in the learning process.

There is reason to conjecture that social climates of classrooms perceived to be characterized by high teacher control may be associated with a passive academic orientation, and anti-school motivation. On the other hand, classroom environments perceived to be high in teacher support, involvement, and affiliation might produce a classroom environment that is related to high student motivation for self-improvement and assertive participation in academic pursuits (Fry & Coe, 1980). But a local study conducted by Amare (2001) indicates that students carry out a school task in classroom better when they are controlled by their teachers than when they are allowed to control themselves, a result the writer believes to be true in the Ethiopian context.

Active effortful involvement on the part of the learner is the critical link between teacher behavior and student achievement and from this viewpoint what the student does is a more important determinant of learning than what the teacher does (Shuell, 1986 in Solmon, 1996).

Researchers have found that students in classrooms which are perceived as high in student involvement and teacher support earned higher average grades (Moos & Moos, 1978).

Students must be intrinsically motivated to achieve the goals of learning a course material, because what students do in the classroom is a more important determinant of learning as Solmon (1996) noted. Intrinsic motivation refers to engagement in actions for their own sake with the only tangible benefit being outcomes such as pleasure, learning, satisfaction, interest, or challenge (Wang, 2001; Pintrich & Shunk, 2002, p.245).

Motivational patterns are like exerting effort, seeking challenging tasks, persisting in the face of difficulty, and attributing success to effort (Solmon, 1996). Changes in these patterns may influence the intrinsic motivation of students. Thus, academic intrinsic motivation for a course can be defined as the enjoyment of learning the course characterized by devoting effort, persisting longer, curiosity/interest, preference of challenging/difficult tasks, and sense of competence in the course.

Intrinsically motivated students participate in learning and study hard because they are curious and interested in the course they learn. Regarding this Lumsden (1994) in Garuma (2005) noted that the course material is interesting, challenging, and the student receives some kind of satisfaction from learning rather than in order to receive award, like passing a test or graduating from school.

High levels of engagement in an activity by devoting much effort and persisting longer are indicatives of intrinsic motivation for the activity (Elliot et al., 2005, p.29). This supports the assumption that students who devote much effort on learning mathematics and persist longer in learning mathematics and doing challenging mathematical problems have high intrinsic motivation for mathematics.

In a study conducted on Korean female high school students, Bong (2005) found a positive and statistically significant relationship between perception of classroom environment and

academic achievement as well as between perception of classroom environment and student motivation.

Mulugeta (1998) found that academic achievement motivation was positively and significantly related to academic performance of both males and females of Addis Ababa University- freshmen students. Garuma (2005) has also found that academic intrinsic motivation was positively and significantly correlated with academic achievement of female preparatory students. But the results of Workineh's (2004) study on elementary school students revealed that students' academic intrinsic motivation was not associated with their academic achievement.

Most of the above local studies have investigated the relationship between motivation and academic achievement for elementary and secondary school students. Only Mulugeta (1998) conducted his study on Addis Ababa University- freshmen students. All of the above writers (local study writers) have also used average mark or CGPA as academic achievement measures. But as Gottfried (1985) suggest, since intrinsic motivation is context and domain specific, it must be measured for specific domains separately and compared with academic achievement of specific subjects separately.

Thus the present study is expected to improve the scarcity of such study at higher education level and has added the variable perception of classroom environment to the variables intrinsic motivation and academic achievement which are investigated by other writers. Moreover, in the present study the writer has measured the three variables for a specific subject, mathematics, as suggested by scholars.

1.2 Statement of the Problem

Students' perception of classroom environment is all about the belief or image they have for the learning environment of a particular course. Perception of mathematics classroom environment is their image for the activities they do in mathematics class, mathematics instructors, their interactions in the classroom, and for the course. These all influence their intrinsic motivation for the course and their academic achievement on the course.

Many books as well as several reports by the National Science Foundation (NSF), address well-known problems associated with Science, Mathematics, and Engineering (SME) education at the undergraduate level (NSF, 1996 cited in Kardash & Wallace, 2001). These authors, citing several writers, noted that one approach to the problem of SME attrition has focused on students' perceptions of SME classes and their reasons for leaving SME majors. As tried to indicate in the previous section students' perception of classroom environment is one factor that influences students' intrinsic motivation and academic achievement.

Learning mathematics at university level involves higher cognitive ability. This is to say that learning mathematics is an active, social process by which each student can develop his/her own understandings of concepts based on applications of previously obtained knowledge (Borchelt, 2007). Adequate preparation in science and mathematics enables students to develop socially and intellectually, and to participate fully in a technological society as informed citizens (Clark, 2006 in Hoang, 2008). Unless students perceived the mathematics classroom environment positively and internally motivated for the course, learning mathematics could hardly be possible.

All of the studies cited in the background section have investigated the relationship between intrinsic motivation or motivation and academic achievement and to the best knowledge of the writer, no research has investigated so far the relationships among science first year students' perceptions of mathematics classroom environment, mathematics intrinsic motivation, and academic achievement on the course in our context. To bridge this gap in knowledge particularly in the Ethiopian context, the researcher wanted to conduct this study.

The purpose of this study is to investigate the relationships among perception of mathematics classroom environment, mathematics intrinsic motivation, and academic achievement on the course for science first year students. Accordingly, the writer planned to answer the following research questions.

- What is the relationship among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement for science first year students in the departments of Computer Science, Statistics, and Earth Science?

- What is the relationship among the different dimensions of perception of mathematics classroom environment (i.e., teacher-student connectedness, teacher support and communication skills, and student engagement) and mathematics intrinsic motivation?
- Do the different dimensions of perception of mathematics classroom environment significantly relate with mathematics achievement?
- Is there a statistically significant gender difference in perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement among first year students in the three departments?

1.3 Objectives of the Study

The general objective of the study is to investigate the relationships among science first year students' perceptions of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement. The specific objectives of the study are to:

- ❖ examine the relationships among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement for first year science students in the departments of Computer Science, Statistics, and Earth Science.
- ❖ investigate the relationships among the different dimensions of students' perceptions of mathematics classroom environment and mathematics intrinsic motivation.
- ❖ investigate the relationships among the different dimensions of students' perceptions of mathematics classroom environment and mathematics achievement for the participants.
- ❖ see if there is statistically significant gender difference on the three measured variables (perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement) among first year students in the three departments.

1.4 Significance of the Study

The findings of this study are expected to add new insight to the theory on the relationships among science first year students' perceptions of mathematics classroom environment, mathematics intrinsic motivation, and mathematics academic achievement in the Ethiopian

context. The participants may make use of the findings to identify the kind of mathematics classroom environment perception that enhances their mathematics intrinsic motivation and academic achievement on the course.

Science instructors in general and mathematics instructors in particular can use the findings of the study to improve their students' learning and to prepare course materials. The faculty academic advisors and counselors can also make use of the findings to improve students' learning.

The findings of the study may also serve as an initial point for those who are interested to conduct further study in the area.

1.5 Limitation of the Study

The pilot study was conducted in the first semester and the entire data were collected in the second semester of 2008/09 academic year. The course Calculus-I, which is considered in the study, was given in the first semester. For this reason some students who had very low achievement and who were thus dismissed and/or withdrawn are not included in the study.

The other limitation was variation of mathematics instructors. There were seven mathematics instructors teaching the course Calculus-I out of which two were PhD holders and the rest MSc holders. Moreover, the grade that the participants scored on the course Calculus-I was taken as mathematics achievement and this has its own limitations.

1.6 Definition of Terms

- Classroom environment- is a room where teaching-learning process takes place.
- Perception of mathematics classroom environment- is the feeling, belief, or an image science first year students have for the classroom environment while they are learning mathematics.

- Teacher-student connectedness- is a close relationship between a student and a teacher such that the teacher follows every activity of the student, approaches the student friendly, and likes the student; and the student can ask and answer freely in the class, likes the teacher, and can contact the teacher any time and place.
- Teacher support and communication skills- means when a teacher listens to students, assists them when trying exercises, initiates them to ask questions, clearly communicates every information in the class including objectives of lessons, and give appropriate feedbacks.
- Student engagement- concerns attending classes regularly, well preparing for classes by reviewing previously learned lessons, actively participating in class by asking and answering, and trying all exercises and assignments.
- Mathematics intrinsic motivation - is the enjoyment of learning mathematics characterized by devoting effort, persisting longer, curiosity/interest, preference of challenging/difficult mathematics tasks, and sense of competence on mathematics.
- Mathematics academic achievement- is mathematics grade that science first year students scored on the course Calculus-I.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 The Concept of Perception of Classroom Environment

Classroom environment is a room in which an instructor and students interact for teaching-learning purpose. Classroom environment is the atmosphere or mood in which a teacher and students interact (Burden, 2003, p.92). This author identifies good and poor classroom environments as “a good classroom environment is warm, supportive, and pleasant whereas a poor classroom environment may be chaotic and disorganized or cold, unfriendly, and threatening”. Students’ perception of classroom environment is the feeling, belief, or image students have for the classroom environment while they are learning.

The students’ perception of classroom environment may have a number of dimensions like teacher-student relationships explained by their connectedness, teacher support and communication skills, and students’ engagement in the classroom teaching-learning activities.

Teacher-student relationship concerns the extent to which students perceive their relationship with their instructor positively, perceive their instructor as supportive, and whether they perceive that their instructor treats them fairly. Positive teacher-student relationships are significantly related with higher student involvement and motivation in learning thereby high academic achievement (Elliot et al., 2005; Lirgg, 1994; Burden, 2003).

Teacher support is the extent to which the teacher helps, befriends, trusts, and is interested in students (Dorman et al., 2005). Teacher communication about classroom norms and procedures that is clear and consistent is associated with greater attentiveness, more time on task and less disruptive behavior (Russell et al., 2004).

Student engagement concerns students’ involvement in the classroom activities and the perception that the activities are meaningful for them. Students’ cognitive engagement concerns the willingness of the students to apply the mental effort to grapple intellectually with challenging and complex material (Elliot et al., 2005, p.29). Student engagement

describes energy in action, the connection between person and activity, student engagement defined more specifically as attitudes to and interest in a particular learning domain (e.g. reading) or self-efficacy in a domain (e.g. mathematics), is a strong predictor of achievement in the respective domains (Russell et al., 2004). Turner and colleagues (1998) conceptualized involvement as a complex interaction of student cognition, motivation, and affect. Sometimes students report being so involved in a learning activity that they lose all sense of time; they become totally engrossed; the activity is all important. This state has been described as 'flow', an optimal state of intrinsic motivation (Russell et al., 2004).

Students' perception of mathematics classroom environment is therefore the students' feeling, belief, or image they have for the classroom environment while they are learning mathematics.

2.2 Theory Related to Perception of Classroom Environment

Most studies investigating classroom goal structure have used students' perceptions about their classroom environment theorizing that students' perceptions affect their cognitions, affect, and behavior (e.g., Ryan, Gheen, and Midgley, 1998; Ames & Archer, 1988). When students perceived their classroom as emphasizing mastery goals, they reported using more learning strategies, preferred tasks that offered challenge, and had a more positive attitude toward their class (Ames & Archer, 1988, p.260).

From a cognitive-mediational perspective, students are recognized as active and controlling agents in their own learning (Doyle, 1977 in Solmon, 1996). Through the lens of their past experience and prior knowledge, they assign meanings to events that occur in instructional settings (Solmon, 1996). This implies that the students' perception of classroom environment is very important for learning to take place. "I recognize that for various reasons, we don't often consider the student perspectives on learning outcomes; relying mostly on our own expertise, or the expertise of others in our fields to determine our curricula and course objectives", Walker (2008).

Emphasizing the importance of students' perception of classroom environment Walker (2008) wrote that many things are going on in the lives of our students, and if we measure the "quality" of institutions by criteria that does not take into account student perceptions of their own learning, then prospective students and their parents, prospective faculty, and administrators – all of those interested in rankings and reputation– are receiving a limited view of the learning that takes place on any given college campus. It is critical that the context of student learning in schools – principally the classroom – is recognized as important to understanding how students perceive their academic capabilities in certain task domains (Dorman et al., 2002).

Classroom environment in which students perceive positive teacher-student relationship, supportive teacher, and engaging are more productive and interesting to the students. There were substantial relationships between student perceptions of the classroom environment dimensions and student self-reports of academic motivation factors (Ames & Archer, 1988).

There is reason to conjecture that social climates of classrooms perceived to be characterized by high teacher control may be associated with a passive academic orientation and anti-school motivation; whereas, classroom environments perceived to be high in teacher support, involvement, and affiliation might produce a classroom environment that is related to high student motivation for self-improvement and assertive participation in academic pursuits (Fry & Coe, 1980).

As students feel more supported they become more engaged and this in turn reduces risk behavior and likelihood of dropping out (Watkins, 2005). Teachers who provide support, demonstrate equity in the classroom, ensure that students complete learning activities and engender student cohesion in science classrooms are more likely to enhance their students' academic efficacy at science and attitude to science (Dorman et al., 2005).

Higher levels of student engagement in the learning activity and the perception that the activity was meaningful appeared to help the students maintain interest (Elliot et al., 2005, p.29). Favorable classroom learning environments are high in student involvement, teacher support, order and organization (Keefe & Jenkins, 1997, p.77).

As Turner and colleagues (1998) reviewed students who are involved in learning describe it as a time of focused concentration, attention, and deep comprehension as well as positive affect, good clarity, and intrinsic motivation. Students need opportunities on a regular basis to engage in learning experiences that enable the construction of deeper understanding regarding mathematical processes, concepts, and relationships (Borchelt, 2007).

Teachers and their students together create the favorable classroom learning environment. A supportive friendly, safe classroom, that emphasizes positive emotions and interactions, contributes to students' social-emotional well-being, resilience, productive coping strategies and engagement in learning (Russell et al., 2004). In supportive environments teachers exhibited behaviors such as expressing enthusiasm for learning, respect for their students, appropriate use of humor and sharing of expectations that all students would and could learn in their classrooms (McNaught, 2007). In a classroom in which students and their teacher interact friendly, there will be sufficient student engagement and the students will certainly like the subject. Regarding this Elliot and colleagues (2005, p.136) wrote that teachers thought that liking a subject and liking a teacher were mutually interactive, so that liking a teacher could induce a sufficient engagement for a subject to become liked, and vice-versa.

In classrooms that provide a significant positive affective environment, students reported considerable intrinsic motivation, additional help seeking, positive emotions related to content, and significant perceptions of task-specific competencies (Schweinle et al., 2006). These authors reviewed that especially as students mature; they need positive relationships with peers and teachers.

As engagement is more directly about behavior, it is more likely to be affected by what happens in relationships with teachers and peers, and by school experiences (Russell et al., 2004). Findings concerning the impact of teacher support on cognitive engagement are beginning to accumulate and point to the importance of a combination of academic and social support (Fredricks et al., 2004).

these authors found that high-involvement teachers created a climate in which error was viewed constructively and high-involvement teachers seemed to exemplify for their students a respect for and an interest in the mathematics per se. The study by Newhouse (1994) supported that the classroom environment which is perceived by students to be most desirable was relatively open ended, student centered and more laissez fair than controlled.

In contrast to the above findings, the findings of Amare (2001) indicate that students carry out a school task in classroom better when they are controlled by their teachers than when they are allowed to control themselves which the writer believes to be true in the Ethiopian context.

Feeling positively about how teachers and students interact in school as well as in classroom may provide a secure emotional basis from which students can both come to enjoy learning and develop their academic competence without feeling self-conscious or worried about failure. Furthermore, positive relationships with teachers may serve a particularly important role in facilitating adjustment during early adolescence when youth need non-parental role models and mentors (Roeser et al., 1996).

When students ask questions and engage in classroom activities the teacher may reflect on this and stimulate positive energy in the classroom. The students' personal interactions influence the behavior of the teacher and that of the entire classroom (Johnsen et al., 2008). Suggestions given by motivational researchers for increasing students' motivation include techniques for changing students' perceptions and beliefs (McCormick & Pressley, 1997, p.38).

International research provides further evidence that students' perception of teacher support and involvement contributes significantly to increased student effort, attentiveness, interest and completion of class work, increased happiness and interest, and decreased anxiety and anger in class, increased self-regulation of learning and decreased disruptive behavior, and decreased dropping out, especially for socially disadvantaged and academically at-risk students (Russell et al., 2004).

Research on the interpersonal aspects of the middle school environment has demonstrated that positive teacher-student relationships in school are related to early adolescents' academic motivation and achievement (Roeser et al., 1996). Both prior student engagement and perceived competence had a significant positive influence on subsequent levels of mathematics achievement, but the influence of perceived academic competence was three times larger than that of engagement (Akey, 2006). Akey's findings further suggest that students who are more academically confident and engaged tend to have more supportive relationships with teachers, and that teachers appear to be more supportive of students whom they perceive as more involved in the academic process.

In addition to the effects of school climate perceptions on students' levels of intrinsic motivation, observed engagement in learning, and academic performance, results contribute to an understanding of processes important to school engagement and performance of young urban African American adolescents (Fenzel & O'Brennan, 2007).

Students, who know what their teachers expect of them in terms of work and social behavior in class, and the consequences of not meeting those expectations, are more likely to be behaviorally engaged (Russell et al., 2004). The findings of Fenzel and O'Brennan (2007) suggest that establishing a supportive and respectful environment in the classroom contributes to students' motivation, to persist at challenging academic work, and their engagement in learning activities in the classroom, in addition to contributing to their academic performance.

2.4 The Concept of Intrinsic Motivation

Huitt (2001) gleaned definitions of motivation from a variety of psychology textbooks and reflect the general consensus that motivation is an internal state or condition (some times described as a need, desire, or want) that serves to activate or energize behavior and give it direction.

Huitt summarizes the definitions as:

- internal state or condition that activates behavior and gives it direction;
- desire or want that energizes and directs goal-oriented behavior;
- influence of needs and desires on the intensity and direction of behavior.

Motivation is widely seen by psychologists in intrapersonal terms, which are as something residing within the individual (Elliot et al., 2005, p.79). The term motivation is used by educators to describe the process of initiating, directing, and sustaining goal-oriented behavior (Educational Psychology, 04/05, p.141).

Motivation can be categorized as intrinsic motivation- the tendency to engage tasks because one finds them interesting, challenging, involving, and satisfying and extrinsic motivation-the tendency to engage tasks because of task-unrelated factors such as promise of rewards and punishments, dictates from superiors, surveillance, and competition with peers (Deci & Ryan, 1985 in Moneta & Siu, 2002).

Intrinsic motivation refers to being involved in an activity for the sheer pleasure that such involvement elicits (Ryan & Deci, 2000 in LeBlanc, 2004). This author wrote that two critical features associated with intrinsic motivation are one's perceptions that one's actions are self-determined (including the opportunity to participate in environments that support autonomous activities) and one's feelings of self-efficacy.

Intrinsic motivation is defined as engagement in actions for their own sake with the only tangible benefit being outcomes such as pleasure, learning, satisfaction, interest, or challenge (Wang, 2001). Intrinsic motivation is associated with activities that are their own rewards, that is, people pursue certain activities with personal interest (Kim et al., 2007). Intrinsic motivation is "the human need to be competent and self-determining in relation to the environment" (Deci, 1980 in Pintrich & Schunk, 2002, p. 258). Intrinsic motivation is the desire to engage in behaviors for no reason other than sheer enjoyment, challenge, pleasure, or interest (Lepper et al., 2005). These authors wrote that the concept of intrinsic motivation emerged in the heyday of Skinnerian thought and research, partially as a contrast to the motivation produced by the popular behavior modification programs of that era, which featured a heavy reliance on more extrinsic incentives and contingencies.

Intrinsic motivation concerns the performance of (or participation in) activities for their own sake in which pleasure is inherent in the activity itself (Garuma, 2005; Pintrich & Shunk,

2002; Gottfried, 1985). Intrinsic motivation is analogous to an emergency battery that provides energy to action in case of back out (Moneta & Siu, 2002). Academic intrinsic motivation concerns enjoyment of school learning and an orientation to master challenging tasks (Gottfried, 1985).

2.5 Theory Related to Intrinsic motivation

Under the cognitive approach, the attribution theory of motivation (Heider, 1958; Weiner, 1974) proposes that every individual tries to explain success or failure of self and other by offering certain “attributions”. These attributions are their internal or external or either under control or not under control. Internal attributions which are under control are closely related to intrinsic motivation. In a teaching-learning environment, it is important to assist the learner to develop a self-attribution explanation of effort (internal locus of control) which is strongly related to intrinsic motivation (Huitt, 2001).

The expectancy theory of motivation proposes that if an individual believes that he/she can be successful at a task (have sense of competence), the individual sees a connection between his/her activity and success, and the individual values the results of success, then the probability that the individual will engage in the required learning activity is high (Huitt, 2001). Intrinsic motivation occurs when the learning activity and the classroom environment elicit motivation in the student (Brandt, 1995; Chance, 1992).

When given an interesting task or assignment without being promised reward or punishment upon completion of the task, persons high in intrinsic motivation continue working on the task, whereas persons low in intrinsic motivation stop working (Moneta & Sui, 2002).

According to goal-theory, in the context of school learning, which involves operating in a relatively structured environment; students with mastery goals outperform students with either performance or social goals. Moreover, students with mastery goals are more likely to select moderately difficult tasks which will provide an interesting challenge, but still the high expectations for success (Huitt, 2001). According to Deci and Ryan (1985) in Kim et al.

(2007), autonomy-supportive classroom environments as opposed to controlling ones are assumed to facilitate self-determination motivation.

Self-determination theory postulates that human beings have three basic psychological needs underpinning self-determined motivation: autonomy (the belief that one is the origin and regulator of his/her actions), competence (the belief that one can efficaciously interact with the environment), and relatedness (the seeking and development of secure and connected relationships with others in one's social context) (Kim et al., 2007). This authors wrote that numerous studies on self-determination theory have shown that as self-determined motivation increases, intrinsic motivation enhances.

The need for intrinsic motivation energizes students' wills, and the will uses the energy of intrinsic motivation to satisfy needs, resolve conflicts among competing needs, and hold needs in check (Pintrich & Schunk, 2002, p.258). A close relationship between perceived competence and intrinsic motivation exists such that the more competent a learner perceives himself/herself in learning, the more intrinsically motivated he/she becomes in learning (Stipeck, 1988 in Garuma, 2005). More competent students are high achievers and this implies that more intrinsically motivated students are high achievers.

An intrinsically motivated student studies because he/she wants to study. The material is interesting, challenging, and rewarding and the student receives some kind of satisfaction from learning rather than in order to receive a reward, like passing a test or graduating from school (Lumsden, 1994 in Garuma, 2005).

Two critical features associated with intrinsic motivation are one's perceptions that one's actions are self-determined (including the opportunity to participate in environments that support autonomous activities) and one's feelings of self-efficacy (LeBlanc, 2004). Martens and Kirschner (2004) reviewed that intrinsic motivation can be predicted from participants' perception of the social environment and the task environment.

Intrinsic motivational patterns have been associated with high perceived ability and control, realistic task analysis and planning, and the belief that effort increases one's ability and control (Broussard and Garrison, 2004). Students who are intrinsically motivated for doing schoolwork are 'more likely to stay in school, to achieve, to evidence conceptual understanding, and to be well adjusted' than students who are more extrinsically motivated (Liu et al., 2004).

Motivation and engagement vary markedly more from class to class for mathematics than for Science and English and this may be the case because mathematics is typically a subject students are more likely to struggle with compared to other subjects (Martin & Marsh, 2004).

2.6 Related Studies on Intrinsic Motivation

Garuma (2005) found a positive and statistically significant relationship between academic intrinsic motivation and academic achievement for preparatory students. He found a positive and statistically significant relationship between intrinsic motivation and academic achievement for female preparatory students and positive non-significant relationship for males when tested separately.

While investigating academic intrinsic motivation in elementary and junior high school students Gottfried (1985) found a statistically significant positive relationship between academic intrinsic motivation and perception of academic competence. Gottfried wrote that specific subject areas played an important role in differentiating these relations. His results further showed that students distinguished both their academic intrinsic motivation and perception of competence by subject area and revealed the importance of measuring academic intrinsic motivation separately in subject areas.

Kim et al. (2007) investigating "the effects of students' intrinsic motivation on academic achievement and preference for cooperative learning" found the following results. (a) Perceived classroom pressure negatively influenced autonomy and competence; (b) Perceived competence showed strong positive impact on intrinsic motivation (standardized coefficient of path was 0.539 and $p < .001$); (c) Intrinsic motivation showed statistically

significant and positive effects on academic achievement; and (d) Perceived competence indicated positive and significant effect on academic achievement.

Lepper and colleagues (2005) found a positive and significant correlation between overall GPA and intrinsic motivation ($r = 0.34, p < .001$) and negative correlation between extrinsic motivation and overall GPA ($r = -0.23, p < .01$) for middle school students. Intrinsic motivation and mathematics self-concept accounted for a unique variance in mathematics performance; and the motivational model as a whole accounted for 22% of the variance (Um et al., 2005).

Intrinsic motivation is positively and significantly related to students' school achievement as measured by both standardized achievement tests and teacher grades (Gottfried, 1985). Gottfried concluded the singularity of mathematics intrinsic motivation as a specific component of mathematics achievement is intriguing. It is clear that mathematics is perceived as a more difficult and challenging subject area than others. Students with higher mathematics intrinsic motivation may therefore be better able to master challenging and difficult mathematics tasks and show higher academic achievement in this subject (Gottfried, 1985).

Zimmerman (1990) in Wang (2001) observed that self-regulated learners display extraordinary effort and persistence during learning and report high self-efficacy, self-attributions, and intrinsic motivation. "In general, the results of our study modestly supported the hypothesis that intrinsic classroom motivation is positively related to academic achievement", Broussard and Garrison (2004).

Yunus and Ali (2009) found significant positive correlations between effort, self-efficacy, and overall motivation with students' overall academic achievement for Malaysian university students. The results of Um et al. (2005) confirm that intrinsic motivation positively affects mathematics performance, whereas external regulation negatively affects mathematics performance. Church et al. (2001) found a direct relationship among perceived classroom environment variables and intrinsic motivation for a chemistry course.

The results of a study by Deci et al. (2001) indicate that rather than focusing on rewards for motivating students' learning, it is important to focus more on how to facilitate intrinsic motivation, for example, by beginning from the students' perspective to develop more interesting learning activities, to provide more choice, and to ensure that tasks are optimally challenging.

Fenzel and Brennan (2007) found that a number of climate variables were related to students' intrinsic motivation for school work and their levels of engagement in academics (as rated by students' homeroom teachers), including students' perceptions of their teachers and principals as caring and supportive and their mathematics and language arts classes as being focused on learning. The change in R^2 was statistically significant, indicating that intrinsic classroom motivation is predictive of mathematics grades after controlling for the influences of race and gender (Broussard & Garrison, 2004).

Unlike to the above studies, Moneta and Siu (2002) found that intrinsic motivation correlated negatively with year-1 self report GPA ($r = -.24$, $p < .009$), while extrinsic motivation correlated positively ($r = .33$, $p < .001$) in their study on year-1 undergraduate General Psychology students. These results indicate that the more intrinsically motivated a student is, the lower is his/her academic achievement, and the more extrinsically motivated a student is, the higher his/her performance.

It is important to note that intrinsic value of learning did not have a significant direct relation to student performance in any of the regressions that included cognitive strategy use or self-regulation (Pintrich & DeGroot, 1990). The results of Workineh (2004) on elementary school students revealed that students' academic intrinsic motivation was not associated with their academic achievement.

2.7 Gender Differences in Perception of Classroom Environment, Mathematics Intrinsic Motivation, and Mathematics Achievement

2.7.1 Perception of Classroom Environment

Citing several writers Lirgg (1994) noted that there is evidence that boys and girls in the same learning context may perceive that learning environment differently. For example, Eccles and Blumenfeld (1985), in a study of junior high schools, suggest that some environments may facilitate boys' achievement, whereas the same context may dampen or have little positive effect on girls' achievement. This may lead female students to perceive their classroom environment negatively.

Girls held more positive perceptions of their significant teachers than boys (Schiff & Tabor, 2003). This can probably induce more positive perceptions of classroom environments in female students than males. Specifically, the writers noted that girls assigned more importance to the four positive characteristics of significant teachers (as being reliable, challenger, supporter, and learning facilitator) and to the three positive images (as an individual who would be remembered in the future, as a friend, and as a mother) than did the boys.

Brady and Eisler (1999) found that male students did seek out more contact with their instructors than female students. They further noted that more male students sat in the first two rows, stayed after class, and raised their hands in class when compared to female students. Nair (2001), citing several writers, noted that studies in the classroom have also shown that girls and boys differ in their perceptions of classroom environment at the primary and secondary levels. But Nair noted that both male and female students perceived their classroom environment similarly at the tertiary level. This author further reviewed that female students seemed to want less of a decision making role in the classroom and they wanted greater cooperation in class.

Small and statistically non-significant gender differences for each learning environment and attitude scale were found. However, male students consistently reported slightly more positive perceptions of classroom environment and attitudes than did females (Hoang, 2008).

2.7.2 Mathematics Intrinsic Motivation

Amare (2001) in his study on high school students found that male students scored relatively higher means than female students in all variables he treated including motivation although not statistically significant. Males may be particularly responsive in ego-involvement situations that promote the use of internal criteria in the evaluation of competence (Harter, 1981 cited in Harackiewicz & Manderlink, 1984).

Significant difference was established in overall motivation scores between the female and male respondents, favoring the females (Broussard & Garrison, 2004). A study on preparatory students in the Ethiopian context by Garuma (2005) indicated that female students have higher intrinsic motivation for general school subjects including mathematics than male preparatory students.

Male students across all the participating countries had higher mathematics self-efficacy and mathematics self-concept scores than females (Russell et al., 2004). Mullis et al. (2000) in Um et al. (2005) found that there was a significant gender difference in mathematics self-concept and attitudes towards mathematics internationally.

2.7.3 Mathematics Achievement

Boys' expectations about their academic performances are often higher than girls' expectations. These sex-based differences in expectations about academic achievement negatively influence girls' willingness to pursue some challenging academic arenas compared with boys' willingness to do so and mathematics is an important example for this difference (McCormick & Pressley, 1997, p.32). In line with this Seleshi (2005) wrote that among other things, girls tend to lag behind boys in their academic performance, notably in mathematics.

Tadesse (2006) found out that the male-female difference in mathematics achievement was statistically significant for sixth through eighth grade students in favor of males but not for

fifth grade students. As cited by this writer Seleshi (2001) reported that in the Ethiopian context, boys do better than girls in mathematics achievement beginning from grade six through high school.

Sex differentiation starts at junior high school and at the same level of grades 6 through 8 girls have been performing very poorly over the last 10 years in mathematics and science (Genet, 1991). During the early-elementary school years, girls surpass boys in mathematics achievement; however, reversal of this pattern begins in junior high school and continues for the remainder of schooling (McCormick & Pressley, 1997, p.32-33). Amare (2001) found statistically significant gender difference in performance for high school students in favor of males.

Many studies have identified the factors that influence under-participation and under-achievement in mathematics. Two such factors are gender differences and mathematics anxiety (Muralidhar & Rika, 2008). Most studies that have investigated gender differences in mathematics achievement at the secondary school level have found substantial differences in favor of males (Seleshi, 2005). There have been, and continue to be, significant gender differences in performance on complex mathematical tasks like calculus (Fennema & Carpenter, 1998 in Hocevar, 1999).

The findings of Beller and Gafni (1996) suggest that gender gap becomes wider as age increases and that mathematics items that were categorized as measurement items and items involving problem solving consistently showed the largest performance gap in favor of boys.

Walkerdine (1989) in Muralidhar and Rika (2008) noted that some studies attribute gender differences in participation in and achievement on mathematical tasks, to stereotypical perceptions of mathematics as a male domain and such a perception held by females towards mathematics, was the result of the nature of the subject itself and the way it was taught. She argued that gender differences had much to do with a myth regarding male superiority in mathematics, and recommended that the causes of the myth be identified and rectified.

Despite efforts to increase the participation of women in high status fields involving mathematics and science, women continue to be less likely than men to pursue a college education in such fields (Bleeker & Jacobs, 2004).

2. 8 Factors Affecting Intrinsic Motivation

2. 8.1 Factors that Enhance Intrinsic Motivation

Lepper and Hodell (1989) in Wang (2001) suggest four methods for enhancing intrinsic motivation:

- i. **Challenge:** Design challenging activities which convey the message to the learners that they have competitive skills. It is essential to find a balance between learner competence and the difficulty of the goals because overly difficult goals are unlikely to increase learner motivation to continue the task if the learners perceive they will never reach the goal. Likewise, goals that are too easily attained do not sufficiently challenge learners to encourage skill development.
- ii. **Curiosity:** Activities that create disequilibria for the learners can elicit curiosity, because presenting discrepant ideas--those that conflict with their prior knowledge or beliefs--can prompt students to seek information that will resolve the discrepancy. As with challenge, moderate discrepancies are most effective because they are easily incorporated into an individual's mental framework; large discrepancies may be rapidly discounted (Pintrich & Schunk, 1996, p.277).
- iii. **Control:** A sense of responsibility will be better fostered in learners if they are allowed to make meaningful choices in the learning process.
- iv. **Fantasy:** The design of simulations and games that involve fantasy can increase intrinsic motivation.

Ryan and Deci (2000) in LeBlanc (2004) suggest that for a high level of intrinsic motivation, feelings of competence must be accompanied by feelings of autonomy. According to Malone and Lepper (1987) in Medina (2005) the elements to enhance intrinsic motivation are; individual balance between skills and challenge, goals whose attainment is uncertain, also presenting surprises or attracting users' attention to stimulate their curiosity.

Verbal rewards typically contain explicit positive performance feedback, so that they are likely to enhance perceived competence and thus enhance intrinsic motivation (Deci et al., 2001). SDT model states that intrinsic motivation is enhanced when social and contextual activities provide an environment which supports feelings of competency (Goldstein, 2008).

Research indicates that verbal rewards (i.e., positive feedback) tend to have an enhancing effect on intrinsic motivation; however, verbal rewards are less likely to have a positive effect for children than for older individuals (Deci et al., 2001). These authors wrote that although positive feedback can enhance intrinsic motivation, it can actually undermine intrinsic motivation if it is administered with a controlling interpersonal style. As Um et al. (2005) noted autonomy-supportive climates would enhance intrinsic motivation, and that controlling climates would undermine intrinsic motivation.

Research indicates that intrinsic motivation is linked to feelings of self-efficacy and the perception that one's actions are self determined; any mechanism designed to enhance both would, consequently, enhance levels of intrinsic motivation (LeBlanc, 2004). Task contingencies that are perceived as promoting self-engagement in tasks or task competence result in enhanced intrinsic motivation (Gottfried et al., 1994).

Student-centered instruction can foster improvements in the intrinsic motivation of students if properly designed and implemented. Problem-solving activities can be some of the most effective methods for using student-centered instruction to enhance intrinsic motivation (Phillips, 2005).

2. 8.2 Factors that Undermine Intrinsic Motivation

One common criticism of the use of extrinsic rewards is that they decrease intrinsic motivation to achieve because students shift their focus away from the material to be learned and instead concentrate solely on the reward (Cameron & Pierce, 1996 in LeBlanc, 2004). It is clear that rewards do not undermine people's intrinsic motivation for dull tasks because there is little or no intrinsic motivation to be undermined (Deci et al., 2001).

Overall, tangible rewards (including material rewards, such as money and prizes, and symbolic rewards, such as trophies and good player awards) would decrease intrinsic motivation, because tangible rewards are frequently used to persuade people to do things they would not otherwise do, that is, to control their behavior (Deci et al., 2001). Both tangible rewards and negative impacts (e.g., threats, deadlines, and imposed goals) reduce the perception of autonomy and thereby reduce intrinsic motivation (Goldstein, 2008).

When self-reported interest served as the dependent measure, all tangible rewards, all expected rewards, engagement-contingent rewards, completion-contingent rewards, and task-contingent rewards significantly undermined intrinsic motivation (Deci et al., 2001). Moreover, these authors wrote that the undermining of intrinsic motivation by tangible rewards was worse for children than for college students, and the enhancement by verbal rewards was weaker for children than for college students.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Research Design

The study employed survey methodology to obtain relevant data from first year students in the Faculty of Science, Addis Ababa University, about their perceptions of mathematics classroom environment and mathematics intrinsic motivation.

3.2 Population and Sample

3.2.1 Population

The population of the study includes all first year students of three departments of the Faculty of Science of Addis Ababa University, namely; Computer Science, Statistics, and Earth Science.

The writer was interested in first year students because these students are exposed to a new classroom environment and their perception of classroom environment and intrinsic motivation need to be investigated. Moreover, first year students are larger in number with better proportions of males and females when compared to year II and III students. The number of students in the population from which participants were selected is given in Table 1.

Table1 Number of students in the population and the sample by department and sex

Group	Sex	Department			Total
		Computer Science	Statistics	Earth Science	
Population	Female	139	19	16	174
	Male	200	148	129	477
	Total	339	167	145	651
Sample	Female	44	10	9	63
	Male	85	54	46	185
	Total	129	64	55	248

3.2.2 Sample

The three departments were selected because all the students of the departments take the mathematics course Calculus-I in the first semester of 2008/09 academic year. First the list of all students in the three departments was obtained from the Faculty's registrar office. The sample size was determined using Yamane's (1967:886) formula (see Appendix IE) and it was found to be 248. Then using a proportional allocation stratified random sampling method, 129 participants from computer science department ($n_1 = 129$), 64 participants from statistics department ($n_2 = 64$), and 55 participants from earth science department ($n_3 = 55$) comprising 248 participants ($n_1 + n_2 + n_3 = n = 248$) were selected for the sample out of 651 students. This method was preferred because the number of students in each department was not proportional.

The number of participants in the sample by department and sex is given in Table 1. Out of the 248 questionnaires, seven questionnaires were not properly responded and the grades for Calculus-I of four students were No Grade (NG). Thus the data of these eleven participants (all male) were excluded from analysis. Therefore, the analysis of the study was done for 124 participants from computer science (Female = 44, Male = 80), 62 participants from statistics (Female = 10, Male = 52), and 51 participants from earth science (Female = 9, Male = 42) comprising a total of 237 participants.

3.3 Variables Included in the Study

The main variables of the study are perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics academic achievement. The psychological constructs, perception and intrinsic motivation, are domain specific. That is, a student may have positive perception for mathematics classroom environment and negative perception for chemistry classroom environment; and a student may have high intrinsic motivation for mathematics and low intrinsic motivation for chemistry. Accordingly, the writer decided to measure these variables for a single mathematics course and thus included mathematics academic achievement as a third variable. The course mathematics was chosen for the study because it was offered to all science first year students.

The other variables are sex, department, year level, and courses taken by science first year students. Sex and department of participants are controlled by including them as independent variables; year level and courses taken are controlled by holding them constant.

3.4 Instruments of Data Collection

The instruments used to collect the relevant data for the study were self-report questionnaire and review of documents. The questionnaire was used to obtain information about students' background, perception of mathematics classroom environment, and mathematics intrinsic motivation. Mathematics grades of participants on the course Calculus-I were obtained from Science Faculty registrar office's records.

The questionnaire was developed based on the literature. It was first prepared in English (see Appendix-II) and then translated into Amharic (see Appendix-III). The Amharic version of the questionnaire was pilot tested on 30 first year computer science students who were excluded later from the sample. Three questionnaires were excluded from analysis due to response set. Based on the analysis of 27 participants, the Amharic version with some modification was administered for the main study. The detail information about the questionnaire is presented below.

Perception of Mathematics Classroom Environment Questionnaire

The students' perception of mathematics classroom environment questionnaire (PMCEQ) was adapted from the works of different scholars. The questionnaire contained three subscales; teacher-student connectedness, teacher support and communication skills, and student engagement. It was a five-point Likert scale ranging from 1 = not at all true of me to 5 = very true of me with negative items reverse scored.

The items for teacher-student connectedness contained some items adapted from Leitao and Waugh's (2007) Teachers' Relationships with Students Questionnaire (students' view) and additional items developed by the researcher for the purpose of this study. The teacher support and communication skills subscale contained items adapted from Akey's (2006) Teacher Support Scale, Leitao and Waugh's (2007) Teachers' Relationships with Students

Questionnaire (students' view), and additional items developed by the researcher. The student engagement subscale items were adapted from Handelsman et al.'s (2005) Student Course Engagement Questionnaire and Akey's (2006) Student Engagement Scale.

The perception of mathematics classroom environment questionnaire contained 24 items (8 items for each subscale). The result of the pilot test shows that the reliability of the scale is fairly good. The Cronbach's alpha for the subscales, teacher-student connectedness, teacher support and communication skills, and student engagement were respectively 0.73, 0.69, and 0.50. The reliability coefficient (Cronbach's alpha) for the total scale with 24 items, i.e., the perception of mathematics classroom environment questionnaire, was found to be 0.85. The PMCE Questionnaire measures perception. As Yalew (2006, p. 228) wrote, for scales designed to measure perception, attitude, and motivation a reliability coefficient of 0.65 is acceptable. Thus, the perception of mathematics classroom environment questionnaire (PMCEQ) seems highly reliable. Since the reliability of the subscales and the scale were acceptable and the item inter-correlations were acceptable, no modification was made for this scale. The results of the pilot study and final instrument are given in Table 2.

Table 2 Results of pilot study and final instrument

Scale	Pilot Test (N=27)		Final Instrument (N=237)	
	No of items	r_{xx}	No of items	r_{xx}
PMCEQ	24	0.845	24	0.864
T-S _C	8	0.729	8	0.740
TSCS	8	0.694	8	0.748
SE	8	0.498	8	0.634
MIMI	20	0.876	19	0.880

Mathematics Intrinsic Motivation Inventory

The Mathematics Intrinsic Motivation Inventory (MIMI) is adapted from the Intrinsic Motivation Inventory (IMI) of Self Determination Theory (SDT) measures and Student-Perceived Academic Competence Scale of Akey (2006). It was a five-point Likert scale ranging from 1 = not at all true of me to 5 = very true of me with negative items reverse scored.

The Mathematics Intrinsic Motivation Inventory initially contained 20 items which was administered for the pilot test. Based on item analysis results, one item (with Item-Total Correlation = -0.002) was excluded from the inventory. Finally the instrument with 19 items was administered for the main study. The instrument's reliability was found to be acceptable (Cronbach α = 0.88).

3.5 Procedure of Data Collection

The writer selected the three departments from which he selected the sample of participants and then he contacted two staff members and one second year postgraduate student who have access to the participants. Then with the help of these three assistants he contacted the students of the three departments. The writer explained the objectives and confidentiality of the study for the students and politely asked them to participate voluntarily.

The students agreed to participate and the researcher told them the date of data collection. The researcher also invited both the students and the three assistants to be present on that date. On the date of data collection, the researcher with the assistants distributed the questionnaire.

Finally, a form that contained the name, sex, and department of participants were prepared to collect the grades of participants on the course Calculus-I from the registrar's office. The mathematics grades that the participants earned on the course Calculus-I were obtained from Science Faculty Registrar's office and were recorded in the form prepared for the purpose.

3.6 Methods of Data Analysis

After all data were collected, the questionnaires were checked. This checking process helped to see if the participants filled in all the required information properly. Questionnaires which were incomplete were separated and excluded from the analysis.

The individual participants and variables were given codes in the coding process. Then code sheets were prepared and all the information in the questionnaires for all participants was filled in the code sheets. The code sheets were also checked. The mathematics grades of all

participants were transferred from the form, which was prepared for the purpose of collecting grades, to the code sheet.

All the data, which were filled in the code sheet, were fed to the computer in a spread sheet of SPSS version 15. Then descriptive statistics of the data were computed using the SPSS program. Correlations, multiple regression analysis, and step-wise regression analysis methods were used to analyze the data using the SPSS program.

CHAPTER FOUR

RESULTS

The present study has investigated the relationships among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement for science first year students in the departments of Computer Science, Statistics, and Earth Science. Moreover, the study dealt with the relationships of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation and mathematics achievement. Gender differences in perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement were also investigated. The results are presented below.

4.1 Results for all Participants

The means and standard deviations of mathematics achievement, mathematics intrinsic motivation, perception of mathematics classroom environment, teacher-student connectedness, teacher support and communication skills, and student engagement are computed for science first year students and presented in Table 3. This Table also contained the bivariate Pearson inter-correlations among the variables.

Table 3 indicates that the relationship of mathematics achievement with mathematics intrinsic motivation and perception of mathematics classroom environment is statistically significant ($r = 0.357, p < .01$ and $r = 0.438, p < .01$, respectively). The relationship of mathematics achievement with perception of mathematics classroom environment is stronger than the one with mathematics intrinsic motivation. The variance in mathematics achievement that is accounted for by PMCE and MIM (that is r^2) is 19.2% and 12.7%, respectively. Mathematics achievement is significantly related with teacher-student connectedness, teacher support and communication skills, and student engagement which collectively explain perception of mathematics classroom environment. Among these the relationship of student engagement and mathematics achievement is the strongest, explaining 16.48% of the variance in mathematics achievement which is about 2% higher than the others.

Table 3 Means, Standard Deviations, and Bivariate Correlations of Variables for all Participants

Variable	Mean	Std. Deviation	Pearson Correlations				
			1	2	3	4	5
1. MAch	2.1214	.96241	-				
2. MIM	3.6460	.58867	.357(**)	-			
3. PMCE	3.5524	.57183	.438(**)	.544(**)	-		
4. T-S _c	3.4225	.65822	.378(**)	.462(**)	.917(**)	-	
5. TSCS	3.6218	.69928	.355(**)	.343(**)	.871(**)	.748(**)	-
6. SE	3.6129	.62620	.406(**)	.622(**)	.802(**)	.625(**)	.484(**)

** Correlation is significant at the 0.01 level (2-tailed), N = 237

Note: MAch=Mathematics Achievement

MIM=Mathematics Intrinsic Motivation

PMCE= Perception of Mathematics Classroom Environment

T-S_c=Teacher-Student Connectedness

TSCS=Teacher Support and Communication Skills

SE=Student Engagement

The results of Table 3 also show that perception of mathematics classroom environment and mathematics intrinsic motivation are positively and significantly related ($r = 0.544$, $p < .01$). Teacher-student connectedness, teacher support and communication skills, and student engagement are also significantly related with mathematics intrinsic motivation ($r = 0.462$, $r = 0.343$, and $r = 0.622$, respectively and $p < .01$ for each).

The composite contribution of teacher-student connectedness, teacher support and communication skills, and student engagement in explaining the variance in mathematics intrinsic motivation is also investigated using multiple regressions, and the results are given in Table 4.

Table 4 Regression Analysis of T-S_C, TSCS, and SE on Mathematics Intrinsic Motivation for all Participants

Variable	B	β	t	p	R	R ²	F	p
Constant	1.441		7.431	.000*	.629	.396	50.819	.000*
T-S _C	.125	.140	1.627	.105				
TSCS	-.022	-.027	-.347	.729				
SE	.514	.547	8.373	.000*				

* $p < .05$

$df1=3, df2=233$

The regression results in Table 4 indicate that teacher-student connectedness, teacher support and communication skills, and student engagement compositely have statistically significant ($R = 0.629, F_{3, 233} = 50.819, p < .05$) relationship with mathematics intrinsic motivation. But when we observe them separately, only the relationship of student engagement and mathematics intrinsic motivation is statistically significant ($B = 0.514, t = 8.373, p < .05$).

The variance in mathematics intrinsic motivation accounted for by the three variables is 39.6%. Step-wise regression analysis shows that 38.6% of this variance is accounted for by student engagement. Teacher-student connectedness and teacher support and communication skills each add less than 1% to the shared variance in mathematics intrinsic motivation (see Appendix –IC for step-wise regression results).

Table 5 Regression Analysis of T-S_C, TSCS, and SE on Mathematics Achievement

Variable	B	β	t	p	R	R ²	F	p
Constant	-.626		-1.718	.087	.448	.201	19.487	.000*
T-S _C	.133	.091	.922	.358				
TSCS	.212	.154	1.748	.082				
SE	.421	.274	3.648	.000*				

* $p < .05$

$df1=3, df2=233$

As can be seen from Table 5, teacher-student connectedness, teacher support and communication skills, and student engagement collectively have statistically significant contribution ($R^2 = 0.201$, $F_{3, 233} = 19.487$, $p < .05$) in predicting mathematics achievement. But when we observe these three variables separately, only student engagement is significantly related to mathematics achievement ($B = 0.421$, $t = 3.648$, $p < .05$).

Table 6 Means and Standard Deviations of PMCE, MIM, and MAch Scores by Sex for all Participants

Variable	Sex	N	Mean	Std. Deviation	t_{cal}	p
PMCE	Male	174	3.6255	.52278	3.340	.001
	Female	63	3.3505	.65243		
MIM	Male	174	3.6918	.59400	2.001	.047
	Female	63	3.5196	.55896		
MAch	Male	174	2.3718	.90350	7.372	.000
	Female	63	1.4297	.76531		

df = 235, 2-tailed, $\alpha = .05$, $t_{cr} = 1.960$

The results in Table 6 indicate that there is statistically significant gender difference in perception of mathematics classroom environment ($t_{cal} = 3.340$, $p < .05$), mathematics intrinsic motivation ($t_{cal} = 2.001$, $p < .05$), and mathematics achievement ($t_{cal} = 7.372$, $p < .05$).

4.2 Results for Computer Science Department

In this subsection the relationships among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement are investigated for first year computer science students. Furthermore, the relationships of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation and mathematics achievement are investigated for these students using multiple regression analysis. Gender differences in perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement are also tested using Independent Samples t-test. And the results of these analyses are presented below.

The inter-correlations among mathematics achievement, mathematics intrinsic motivation, perception of mathematics classroom environment, teacher-student connectedness, teacher support and communication skills, and student engagement were calculated for computer science first year students. These were done to investigate the relationships among the variables at department level. But the results revealed similar findings as in Table 2 for all participants taken together (see Appendix-IA).

Table 7 Regression Analysis of T-S_C, TSCS, and SE on Mathematics Intrinsic Motivation for Computer Science Students

Variable	B	β	t	p	R	R ²	F	p
Constant	1.726		6.866	.000*	.587	.345	21.040	.000*
T-S _C	.237	.277	2.241	.027*				
TSCS	.029	.037	.353	.725				
SE	.289	.340	3.452	.001*				

*p<.05 df1=3, df2=120

The results of multiple regression analysis in Table 7 show that teacher-student connectedness, teacher support and communication skills, and student engagement together significantly relate with mathematics intrinsic motivation ($R = 0.587$, $F_{3, 120} = 21.040$, $p < .05$) for first year computer science students. If we observe the significance of the relationships of the variables separately, student engagement and teacher-student connectedness each significantly relate with mathematics intrinsic motivation ($B = 0.289$, $t = 3.452$, $p < .05$ and $B = 0.237$, $t = 2.241$, $p < .05$, respectively). But the relationship of teacher support and communication skills with mathematics intrinsic motivation is not statistically significant ($B = 0.029$, $t = 0.353$, $p > .05$).

Table 8 Regression Analysis of T-S_c, TSCS, and SE on Mathematics Achievement for Computer Science Students

Variable	B	β	t	p	R	R ²	F	p
Constant	-.159		-.372	.711	.370	.137	6.341	.000*
T-S _c	.071	.056	.398	.692				
TSCS	.175	.149	1.237	.218				
SE	.284	.226	1.999	.048*				

* $p < .05$ $df_1=3, df_2=120$

The results in Table 8 indicate that student engagement, teacher support and communication skills, and teacher-student connectedness together are significantly related with mathematics achievement of computer science first year students ($R = 0.370, F_{3,120} = 6.341, p < .05$). If we look at the individual regression coefficients of the variables, only that of student engagement is statistically significant ($B = 0.284, t = 1.999, p < .05$). This implies that only student engagement is significantly related with mathematics achievement.

Gender differences in mean scores of perception of mathematics classroom environment ($t_{cal} = 2.223, p < .05$), mathematics intrinsic motivation ($t_{cal} = 2.041, p < .05$), and mathematics achievement ($t_{cal} = 4.348, p < .05$) were statistically significant for Computer Science students (see Appendix-IB).

4.3 Results for Statistics Department

In this subsection the relationships among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement are investigated for first year statistics students. Moreover, the relationships of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation and mathematics achievement are dealt for these students using multiple regression analysis. Gender differences in perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement are also tested using Independent Samples t-test. And the results of these analyses are presented in Tables 9 through 12.

The means, standard deviations, and bivariate correlations of mathematics achievement, mathematics intrinsic motivation, perception of mathematics classroom environment, teacher-student connectedness, teacher support and communication skills, and student engagement are computed for first year statistics students. And the results are given in Table 9.

Table 9 Means, Standard Deviations, and Bivariate Correlations of Variables for Statistics Students

Variable	Mean	Std. Deviation	Pearson Correlations				
			1	2	3	4	5
1. MAch	2.7419	.81970	-				
2. MIM	3.7479	.64461	.330(**)	-			
3. PMCE	3.8206	.48142	.221	.659(**)	-		
4. T-S _c	3.7238	.55862	.071	.405(**)	.879(**)	-	
5. TSCS	3.9556	.56680	.085	.422(**)	.877(**)	.745(**)	-
6. SE	3.7823	.58057	.398(**)	.837(**)	.786(**)	.496(**)	.489(**)

** Correlation is significant at the 0.01 level (2-tailed), N = 62

The results in Table 9 revealed that mathematics achievement is significantly related with mathematics intrinsic motivation ($r = 0.330$, $p < .01$) and student engagement ($r = 0.398$, $p < .01$). But perception of mathematics classroom environment, teacher support and communication skills, and teacher-student connectedness each was not significantly related with mathematics achievement. Perception of mathematics classroom environment and its components (subscales) were significantly related with mathematics intrinsic motivation.

Table 10 Regression Analysis of T-S_c, TSCS, and SE on Mathematics Intrinsic Motivation for Statistics Students

Variable	B	β	t	P	R	R ²	F	p
Constant	.219		.589	.558	.837	.701	45.397	.000*
T-S _c	-.052	-.045	-.410	.683				
TSCS	.054	.047	.430	.669				
SE	.928	.836	9.902	.000*				

* $p < .05$

$df_1=3$, $df_2=58$

The multiple correlation coefficient (R) in Table 10 indicate that student engagement, teacher support and communication skills, and teacher-student connectedness together are significantly related with mathematics intrinsic motivation ($R = 0.837$, $F_{3, 58} = 45.397$, $p < .05$). But if we observe the individual coefficients of regression, only that of student engagement is statistically significant ($B = 0.928$, $t = 9.902$, $p < .05$). This shows that only the relationship between student engagement and mathematics intrinsic motivation is statistically significant.

Table 11 Regression Analysis of T-S_c, TSCS, and SE on Mathematics Achievement for Statistics Students

Variable	B	β	t	p	R	R ²	F	p
Constant	1.160		1.484	.143	.426	.181	4.275	.009*
T-S _c	-.188	-.128	-.698	.488				
TSCS	-.086	-.059	-.325	.746				
SE	.692	.490	3.507	.001*				

* $p < .05$ $df1=3, df2=58$

The multiple regression results in Table 11 show that teacher-student connectedness, teacher support and communication skills, and student engagement together are significantly related with mathematics achievement of statistics first year students ($R = 0.426$, $F_{3,58} = 4.275$, $p < .05$). The regression coefficients of each variable show that only student engagement is significantly related with mathematics achievement ($B = 0.692$, $t = 3.507$, $p < .05$).

The results in Table 12 indicate that there is statistically significant gender difference in mean mathematics achievement score ($t_{cal} = 4.146$, $p < .05$). The results further show that the gender differences in mean scores of perception of mathematics classroom environment ($t_{cal} = -0.477$, $p > .05$) and mathematics intrinsic motivation ($t_{cal} = -1.012$, $p > .05$) are not statistically significant.

Table 12 Means and Standard Deviations of PMCE, MIM, and MAch Scores by Sex for Statistics Students

Variable	Sex	N	Mean	Std. Deviation	t_{cal}	p
PMCE	Male	52	3.8077	.51072	-.477	.635
	Female	10	3.8875	.29466		
MIM	Male	52	3.7115	.68143	-1.012	.315
	Female	10	3.9368	.37117		
MAch	Male	52	2.9102	.75887	4.146	.000
	Female	10	1.8670	.52597		

$df = 60$, 2-tailed, $\alpha = .05$, $t_{cr} = 2.000$

4.4 Results for Earth Science Department

Means, standard deviations, and bivariate correlations of mathematics achievement, mathematics intrinsic motivation, perception of mathematics classroom environment, teacher-student connectedness, teacher support and communication skills, and student engagement are computed for earth science first year students. Moreover, to investigate the relationships of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation and mathematics achievement for earth science first year students regression analysis is done, and the results are the following.

Table 13 Means, Standard Deviations, and Bivariate Correlations of Variables for Earth Science Students

Variable	Mean	Std. Deviation	Pearson Correlations				
			1	2	3	4	5
1. MAch	2.4512	.84006	-				
2. MIM	3.6192	.55327	.372(**)	-			
3. PMCE	3.5711	.50945	.500(**)	.349(*)	-		
4. T-S _C	3.4534	.61946	.449(**)	.341(*)	.923(**)	-	
5. TSCS	3.5441	.67584	.456(**)	.063	.890(**)	.769(**)	-
6. SE	3.7157	.48353	.368(**)	.579(**)	.734(**)	.560(**)	.431(**)

** Correlation is significant at the 0.01 level (2-tailed), $N = 51$

* Correlation is significant at the 0.05 level (2-tailed).

The bivariate correlations in Table 13 indicate that mathematics achievement of earth science first year students is significantly related with their mathematics intrinsic motivation ($r = 0.372, \alpha = .01$) and perception of mathematics classroom environment ($r = 0.500, \alpha = .01$). Teacher-student connectedness, teacher support and communication skills, and student engagement are separately and significantly related with mathematics achievement ($r = 0.449, r = 0.456, \text{ and } r = 0.368$, respectively at $\alpha = .01$).

The correlation between mathematic intrinsic motivation and perception of mathematics classroom environment is positive and statistically significant ($r = 0.349, p < .05$). Mathematics intrinsic motivation is strongly correlated with student engagement ($r = 0.579, \alpha = .01$). The correlation between mathematics intrinsic motivation and teacher-student connectedness is also statistically significant ($r = 0.341, \alpha = .05$). But the relationship of teacher support and communication skills with mathematics intrinsic motivation is not statistically significant.

Table 14 Regression Analysis of T-S_C, TSCS, and SE on Mathematics Intrinsic Motivation for Earth Science Students

Variable	B	β	t	p	R	R ²	F	p
Constant	1.399		2.866	.006*	.658	.433	11.980	.000*
T-S _C	.359	.402	2.145	.037*				
TSCS	-.401	-.490	-2.850	.006*				
SE	.647	.565	4.264	.000*				

* $p < .05$

$df1=3, df2=47$

As can be observed from Table 14, teacher-student connectedness, teacher support and communication skills, and student engagement together are significantly related to mathematics intrinsic motivation ($R = 0.658, F_{3,47} = 11.980, p < .05$). Student engagement ($B = 0.647, t = 4.264, p < .05$), teacher support and communication skills ($B = -0.401, t = -2.850, p < .05$), and teacher-student connectedness ($B = 0.359, t = 2.145, p < .05$) are also individually and significantly related with mathematics intrinsic motivation. Step-wise

regression analysis is done to identify the relative strength of relationship of the three variables and the results are given in Table 15.

Table 15 Step-wise Regression Analysis for SE and TSCS on Mathematics Intrinsic Motivation for Earth Science Students

Model	Variable	B	β	T	P	R	R ²	F	p
1 (df1=1, df2=49)	Constant	1.159		2.320	.025*	.579	.335	24.680	.000*
	SE	.662	.579	4.968	.000*				
2 (df1=2, df2=48)	Constant	1.404		2.772	.008*	.615	.378	14.576	.000*
	SE	.775	.678	5.371	.000*				
	TSCS	-.188	-.230	-1.819	.075				

* $p < .05$

Table 15 shows that student engagement explained 33.5% of the variance in mathematics intrinsic motivation. When the variable teacher support and communication skill is added to the regression model, the shared variance has increased by 4.3%. Table 14 also shows that teacher-student connectedness, teacher support and communication skill, and student engagement explained 43.3% of the variance in mathematics intrinsic motivation. The variance accounted for by teacher-student connectedness is 5.5%.

Table 16 Regression Analysis of T-S_c, TSCS, and SE on Mathematics Achievement for Earth Science Students

Variable	B	β	t	P	R	R ²	F	p
Constant	-.520		-.610	.545	.501	.251	5.263	.003*
T-S _c	.195	.144	.670	.506				
TSCS	.338	.272	1.378	.175				
SE	.295	.170	1.116	.270				

* $p < .05$

df1=3, df2=47

The results in Table 16 indicate that the multiple correlation of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics achievement is statistically significant ($R = 0.501$, $F_{3, 47} = 5.263$, $p < .05$). The regression coefficients show that the relationships of teacher-student connectedness ($B = 0.195$, $t = 0.670$, $p > .05$), teacher support and communication skills ($B = 0.338$, $t = 1.378$, $p > .05$), and student engagement ($B = 0.295$, $t = 1.116$, $p > .05$) separately with mathematics achievement are not statistically significant.

Table 17 Means and Standard Deviations of PMCE, MIM, and MAch Scores by Sex for Earth Science Students

Variable	Sex	N	Mean	Std. Deviation	t_{cal}	p
PMCE	Male	42	3.6448	.44442	2.331	.024
	Female	9	3.2269	.66930		
MIM	Male	42	3.6842	.48836	1.857	.069
	Female	9	3.3158	.75173		
MAch	Male	42	2.5952	.76699	2.824	.007
	Female	9	1.7789	.88223		

$df = 49$, 2-tailed, $\alpha = .05$, $t_{cr} = 2.021$

The results of Table 17 indicate that gender differences in mean scores of perception of mathematics classroom environment ($t_{cal} = 2.331$, $p < .05$) and mathematics achievement ($t_{cal} = 2.824$, $p < .05$) among earth science first year students are statistically significant. But the gender difference in mean mathematics intrinsic motivation score is not statistically significant ($t_{cal} = 1.857$, $p > .05$).

CHAPTER FIVE

DISCUSSION

The purpose of this study is to investigate the relationships among perception of mathematics classroom environment, mathematics intrinsic motivation, and academic achievement on the course for science first year students. Thus to attain this purpose, this chapter discusses if the results of the study answer the initially raised research questions.

5.1 The Relationships among Perception of Mathematics Classroom Environment, Mathematics Intrinsic Motivation, and Mathematics Achievement

The findings of the study revealed that mathematics achievement of science first year students is positively and significantly related with their perception of mathematics classroom environment and mathematics intrinsic motivation. The results show that the relationship between mathematics achievement and perception of mathematics classroom environment is stronger than the one between mathematics achievement and mathematics intrinsic motivation.

These results show that students who perceive their mathematics classroom environment positively do probably achieve higher in mathematics than those who perceive it negatively. This means that students, who have close relationships with their instructors, perceive their instructors as supportive and clearly communicate their expectations, and actively engage in classroom activities may achieve better in mathematics than those who do not.

This finding supports several findings by others (e.g., Akey, 2006; Roeser et al., 1996; Handelsman et al., 2005). For example, Akey (2006) found that both prior student engagement and perceived competence had a significant positive influence on subsequent levels of mathematics achievement. Roeser et al. (1996) also found that positive teacher-student relationships in schools are related to adolescents' academic motivation and achievement. Furthermore, the results of the study indicated that more intrinsically motivated students do better achieve in mathematics. That is, students who devote more effort, persist

longer, prefer optimally challenging mathematics tasks may achieve better in mathematics than those who do not.

This finding is inline with the findings of several writers (e.g., Garuma, 2005; Lepper et al., 2005; Kim et al., 2007; Yunus and Ali, 2009). For instance, Garuma (2005) found a positive and statistically significant relationship between academic intrinsic motivation and academic achievement of preparatory students. Kim and colleagues (2007) also found intrinsic motivation to have positive and significant effect on academic achievement.

The present results contradict the findings of several writers (e.g., Moneta & Siu, 2002; Pintrich & DeGroot, 1990; and Workineh, 2004). For instance, Moneta and Siu (2002) found intrinsic motivation correlated negatively with self-report CGPA of year-1 undergraduate General Psychology students.

The present results clearly shown that for a student to achieve better in mathematics, which is perceived to be tougher than other subjects, he/she must perceive the classroom environment positively and he/she must devote more effort, persist longer, prefer optimally difficult mathematics tasks, and perceive himself/herself as competent in mathematics.

The present findings further revealed that perception of mathematics classroom environment and mathematics intrinsic motivation are positively and significantly related. This result suggests that students with positive perceptions of mathematics classroom environment may have high mathematics intrinsic motivation and vice versa. This result supports the findings of Church et al. (2001) who found a significant positive relationship between perceived classroom environment variables and intrinsic motivation for a chemistry course. Fenzel and Brennan (2007) also reported strong relationship between school environment perceptions and intrinsic motivation which supports the present finding.

All the above relationships among mathematics achievement, mathematics intrinsic motivation, and perception of mathematics classroom environment were also investigated at department level. The results of the analysis at department level revealed quite similar results as in the case of all first year science students of the three departments taken together except

for statistics students in one case. That is, the relationship between perception of mathematics classroom environment and mathematics achievement was not statistically significant for statistics first year students.

5.2 The Relationships of Teacher-Student Connectedness, Teacher Support and Communication Skills, and Student Engagement with Mathematics Intrinsic Motivation

The bivariate correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation of science first year students are positive and statistically significant. This means that as a student becomes more connected with his/her teacher, perceived his/her teacher as supportive and communicative, and as he/she becomes more engaged in mathematics classroom activities, then he/she will be more intrinsically motivated in mathematics and vice versa.

Despite the above significant bivariate correlations, multiple regression analysis indicated that teacher-student connectedness and teacher support and communication skills were non-significant predictors of mathematics intrinsic motivation of science first year students. This shows insignificant relationship among the variables. Student engagement significantly predicted mathematics intrinsic motivation. This shows significant relationship between the variables.

The results show that out of the three components of perceptions of mathematics classroom environment only student engagement is positively and significantly related with mathematics intrinsic motivation. These findings suggest that the most important thing to enhance mathematics intrinsic motivation of science first year students is to actively engage them in mathematics classroom activities.

The present findings are inline with the findings of several writers (e.g., Russell et al., 2004; Elliot et al., 2005; Turner et al., 1998). For example, Elliot and colleagues wrote that higher levels of student engagement in learning activities and the perception that the activity was meaningful appeared to help the students maintain interest. Burden (2003) noted that positive

teacher-student relationships are significantly related with higher student motivation which contradicts the present finding. Ames and Archer (1988) also found that classroom environment in which students perceive positive teacher-student relationship and supportive teacher are more productive and interesting which contradicts the present finding.

The relationships of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation were also investigated at department level. The bivariate correlations of the three variables with mathematics intrinsic motivation of computer science first year students were all positive and significant. Multiple regression analysis also shows that teacher-student connectedness, teacher support and communication skills, and student engagement collectively are significantly related with mathematics intrinsic motivation.

Student engagement is the best predictor of mathematics intrinsic motivation followed by teacher-student connectedness. This shows that the two variables are positively and significantly related with mathematics intrinsic motivation of computer science first year students. That is, as computer science first year students become more engaged in mathematics class activities and have close relationship with their instructors they may develop high mathematics intrinsic motivation.

The Pearson correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation of statistics first year students were positive and statistically significant. According to these correlations, as statistics students develop close relationship with their mathematics instructors; perceive their instructors as supportive and communicative, and become more engaged in mathematics class activities then they may become more intrinsically motivated in mathematics.

Multiple regression analysis indicated that teacher-student connectedness, teacher support and communication skills, and student engagement together are significantly related with mathematics intrinsic motivation for statistics students. But the results show that only student engagement significantly predicted mathematics intrinsic motivation. This suggests that for

statistics first year students to develop high mathematics intrinsic motivation, they need only to actively engage in mathematics class activities.

The correlation of mathematics intrinsic motivation of earth science first year students with their engagement in class activities was positive and significant followed by its correlation with teacher-student connectedness. But its correlation with teacher support and communication skills was not statistically significant. This implies that students who are highly engaged in class activities and have good relationships with their instructors may have high mathematics intrinsic motivation.

The multiple regression analysis indicated that teacher-student connectedness, teacher support and communication skills, and student engagement together significantly predicted mathematics intrinsic motivation of earth science first year students. The regression coefficients (B's) have shown that teacher-student connectedness and student engagement have significant direct relationships with mathematics intrinsic motivation. But teacher support and communication skills have significant indirect relationship. Step-wise regression analysis shows that student engagement is the best predictor of mathematics intrinsic motivation of earth science students.

5.3 The Relationships of Teacher-Student Connectedness, Teacher Support and Communication Skills, and Student Engagement with Mathematics Achievement

Each of the correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics achievement of science first year students was positive and significant. The multiple regression analysis also revealed that these three variables together are significantly related with mathematics achievement of science first year students. But the regression coefficients have shown that only student engagement was significant predictor of mathematics achievement. These results suggest that good mathematics grade could be achieved with high probability even only when the students are actively engaged in mathematics class activities.

Russell and colleagues (2004) noted that student engagement is a strong predictor of achievement in particular learning domains (e.g., mathematics) which supports the present finding. This finding is also inline with the findings of Handelsman et al. (2005) who found student engagement in a mathematics course highly associated with high mathematics achievement of non-mathematics majors.

For computer science students, teacher-student connectedness, teacher support and communication skills, and student engagement each significantly correlated with mathematics achievement. The multiple correlation coefficient (R) has also shown that these three variables together are significantly related with mathematics achievement of computer science students. But the regression coefficients have shown that only student engagement is significant predictor of mathematics achievement.

Among the components of perception of mathematics classroom environment, only student engagement significantly correlated with mathematics achievement of statistics first year students. The regression coefficients have also shown that only student engagement is significant predictor of mathematics achievement for these students.

The Pearson correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics achievement of earth science first year students were all positive and significant. The multiple correlation coefficient (R) has also shown that these three variables together were significantly related with mathematics achievement. The results show that as earth science students become closely related with their mathematics instructors, perceive their mathematics instructors as supportive and communicative, and actively engaged in mathematics class activities, then they may achieve better in mathematics.

Despite the above results, the regression coefficients of teacher-student connectedness, teacher support and communication skills, and student engagement are not significant. This shows that the variables do not contribute meaningful amount to the prediction of mathematics achievement separately in case of earth science first year students. That is,

having actively engaged in mathematics class activities may not guarantee to achieve better unless the student has close relationship with his/her instructor, perceive that the instructor is supportive and communicative at the same time. In other words for earth science students to achieve better in mathematics, the interaction of teacher-student connectedness, teacher support and communication skills, and student engagement is important.

5.4 Gender Differences in Perception of Mathematics Classroom Environment, Mathematics Intrinsic Motivation, and Mathematics Achievement

The results of the study have shown that male science first year students scored significantly higher in mean scores of perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement than their female counterparts. These results indicated that male students had more positive perceptions of their mathematics classroom environment, more intrinsically motivated in mathematics, and achieved better in mathematics when compared to the female students. That is, male students had more close relationships with their mathematics instructors; perceived their mathematics instructors as supportive and know what is expected of them; and they were more actively engaged in mathematics classroom activities when compared with female students. Male students devoted more effort, persisted longer, were more interested, preferred more challenging mathematics tasks, and had sense of competence on mathematics when compared to female students.

The results support the findings of Brady and Eisler (1999) who found that male students did seek out more contact with their instructors; sat in the first two rows and actively engaged in class activities than female students. In line with the present findings, Russell et al. (2004) noted that male students surpass females in mathematics self-efficacy and mathematics self-concept scores which are indicatives of mathematics intrinsic motivation. But the results contradict the findings of Broussard and Garrison (2004) and Garuma (2005) whose findings indicate that female students have higher scores of intrinsic motivation for general school subjects including mathematics.

Furthermore, the findings of the present study contradict the findings of Schiff and Tabor (2003) which is girls held more positive perceptions of their significant teachers than boys. Nair's (2001) finding, that is, male and female students in the primary and secondary levels significantly differ in perception of classroom environment, but they perceive it similarly in the tertiary level also contradict the present finding. The findings of the present study seem true in our context. This is because our culture itself does not encourage female students to engage in activities equally with males. The culture they grown up does not encourage them to interact with males, be it classmates or teachers, so they can't freely contact and ask their teachers.

At department level, the gender differences in mean scores of perception of mathematics classroom environment and mathematics intrinsic motivation were statistically significant only for computer science first year students in favor of males. These results have shown that first year students of statistics and earth science perceived their mathematics classroom environment similarly and had similar levels of mathematics intrinsic motivation.

Gender difference in mathematics achievement was tested using independent samples t-test for all participants collectively and at department level. The results have shown that male first year science students significantly surpass females in mathematics achievement at all levels. That is, the gender difference in mean mathematics achievement score was statistically significant in favor of males for all participants taken together and at each department level. The findings support the results of several studies (e.g., Amare, 2001; Seleshi, 2001; 2005; Tadesse, 2006; McCormick and Pressley, 1997). For example, McCormick and Pressley (1997) wrote that during the early-elementary school years, girls surpass boys in mathematics achievement; however, reversal of this pattern begins in junior high school and continues for the remainder of schooling.

CHAPTER SIX

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

6.1 Summary

The objective of the study was to investigate the relationship among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement on the course Calculus-I for science first year students. To achieve this objective, the following research questions were raised.

1. What is the relationship among perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement for science first year students in the departments of Computer Science, Statistics, and Earth Science?
2. What is the relationship among the different dimensions of perception of mathematics classroom environment (i.e., teacher-student connectedness, teacher support and communication skills, and student engagement) and mathematics intrinsic motivation?
3. Do the different dimensions of perception of mathematics classroom environment significantly relate with mathematics achievement?
4. Is there a statistically significant gender difference in perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement among first year students in the three departments?

The study employed survey methodology to obtain relevant data from first year students in the Faculty of Science, Addis Ababa University, about their perceptions of mathematics classroom environment and mathematics intrinsic motivation.

The study used a stratified random sampling method to select a sample of 248 participants from a population of 651 science first year students of Computer Science, Statistics, and Earth Science departments from the Science Faculty, Addis Ababa University.

The required data for the study were collected using perception of mathematics classroom environment questionnaire and mathematics intrinsic motivation inventory which were

prepared for this purpose. The mathematics grades of participants on the course Calculus-I were also obtained from the faculty registrar's recorded document.

The data of 237 participants were fed from a code sheet into a spread sheet of an SPSS 15 program after checking and coding all the variables in the study. Then descriptive statistics of the data were computed using the SPSS program. Correlations, multiple regression analysis, and step-wise regression analysis methods were used to analyze the data using the SPSS program.

The results of the study have revealed that mathematics achievement of science first year students was positively and significantly related with their perception of mathematics classroom environment and mathematics intrinsic motivation. The present findings further revealed that perception of mathematics classroom environment and mathematics intrinsic motivation were positively and significantly related. These relationships were quite similar at department level except in one case for statistics students. That is, the relationship between perception of mathematics classroom environment and mathematics achievement was not statistically significant for statistics first year students.

The correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation of science first year students were each positive and statistically significant. Multiple regression analysis has also shown that these three variables together significantly predicted mathematics intrinsic motivation. But the multiple regression coefficients have shown that out of the above three variables only student engagement significantly predicted mathematics intrinsic motivation of science first year students. This shows significant relationship between student engagement and mathematics intrinsic motivation.

The Pearson correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation for computer science and statistics first year students were positive and significant. Multiple regression analyses have also shown that these three variables together significantly predicted

mathematics intrinsic motivation in both departments. But the regression coefficients have shown that the best predictor of mathematics intrinsic motivation was student engagement.

Student engagement and teacher-student connectedness were positively and significantly correlated with mathematics intrinsic motivation of earth science first year students. The multiple regression analysis indicated that teacher-student connectedness, teacher support and communication skills, and student engagement together were significantly related with mathematics intrinsic motivation of earth science first year students. The multiple regression analysis further indicated that student engagement and teacher-student connectedness each had significant direct relationship with mathematics intrinsic motivation. But teacher support and communication skills had significant indirect relationship with mathematics intrinsic motivation of earth science students.

Each of the Pearson correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics achievement of science first year students was positive and significant. Multiple regression analysis has also shown that the above three variables together were significantly related with mathematics achievement of the participants. But the regression coefficients have shown that only student engagement was significant predictor of mathematics achievement for science first year students.

Each of the Pearson correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics achievement was positive and significant for computer science and earth science first year students. Taken together in the multiple regression model, these three variables were significantly related with mathematics achievement for these students. Despite these relationships, the results have shown that only student engagement is significant predictor of mathematics achievement for computer science students and none of the above three variables contributed significant amount to the prediction of mathematics achievement separately for earth science first year students.

The correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics achievement of statistics first year students have shown that only the one between student engagement and mathematics achievement was significant. The regression coefficients have also shown that only student engagement was significant predictor of mathematics achievement of these students.

The results of the study have shown that male science first year students scored significantly higher in mean scores of perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement than their female counterparts.

At department level, the gender differences in mean scores of perception of mathematics classroom environment and mathematics intrinsic motivation were statistically significant only for computer science first year students in favor of males. These results have shown that first year students of statistics and earth science perceived their mathematics classroom environment similarly and had similar levels of mathematics intrinsic motivation. Gender differences in mean mathematics achievement scores were statistically significant in favor of males in each department.

6.2 Conclusion

Mathematics achievement of science first year students was positively and significantly related with both their perception of mathematics classroom environment and mathematics intrinsic motivation. Moreover, perception of mathematics classroom environment and mathematics intrinsic motivation were positively and significantly related. These relationships were quite similar at department level but the relationship between perception of mathematics classroom environment and mathematics achievement was not statistically significant for statistics first year students.

Each of the correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics intrinsic motivation as well as with mathematics achievement of science first year students was positive and significant. Multiple regression analysis has also shown that these three variables together significantly predicted

mathematics intrinsic motivation and mathematics achievement. But the results have also shown that out of the above three variables only student engagement significantly predicted mathematics intrinsic motivation and mathematics achievement of science first year students.

Each of teacher-student connectedness, teacher support and communication skills, and student engagement was positively and significantly correlated with mathematics intrinsic motivation for computer science and statistics first year students at department level. Multiple regression analysis has shown that these three variables together significantly predicted mathematics intrinsic motivation in both departments.

Correlations of teacher-student connectedness, teacher support and communication skills, and student engagement with mathematics achievement were positive and significant for computer science and earth science students at department level. In case of statistics students, only the correlation between student engagement and mathematics achievement was positive and statistically significant. Multiple regression analysis has shown that teacher-student connectedness, teacher support and communication skills, and student engagement together were significantly related with mathematics achievement at department level. In all cases the variable which explained the highest variance in the prediction of mathematics achievement as well as mathematics intrinsic motivation is student engagement.

The findings of the study have revealed statistically significant gender differences in mean scores of perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement among science first year students in favor of males.

Gender differences in mean mathematics achievement scores were statistically significant in favor of males at each department level. And gender differences in mean scores of perception of mathematics classroom environment and mathematics intrinsic motivation were statistically significant only for computer science first year students in favor of males.

6.3 Recommendations

Based on the obtained results the following recommendations are forwarded.

Teachers should help students perceive their classroom environment positively and develop intrinsic motivation for the course they teach. Teachers can do this by actively engaging students in classroom activities which help enhance their academic achievement. Moreover, Reda (2006) suggest that teachers should model interest in learning; communicate to students reasons for being enthusiastic about school; create low anxiety classrooms; induce curiosity and suspense; and make abstract material more personal, concrete, and familiar.

Student engagement is found to be the strongest predictor of mathematics intrinsic motivation and mathematics achievement. Thus teachers should engage students in classroom activities using classworks, homeworks, assignments, and projects to make teaching-learning engaging and productive.

The results have shown significant gender difference in perception of mathematics classroom environment, mathematics intrinsic motivation, and mathematics achievement in favor of males. With this gap between the two groups, progress in education is unthinkable for two reasons; one is females make up at least half of the society and the other is mathematics is crucial in all sectors. Therefore, all concerned bodies should help bridge this gap. Male students should encourage their female classmates to discuss, interact, and participate with them during mathematics classes and exercises. Teachers should also encourage female students to freely participate in class and to freely ask help. Institutions should help female students to compete with their male counterparts. For example, as written by “The Ethiopian Herald” Tuesday 7 April 2009 page 9, under the title “University Working to Make Female Students Successful” the Hawassa University has launched guidance and counseling service aimed at solving social, economical, and academic problems female students are facing. The activities include arranging tutorial classes, facilitating financial and material support for female students.

If all institutions follow the start of Hawassa University, the gender gap found in this study will be hopefully very small if not eliminated all together.

Finally, further study should be done on the area by minimizing the limitations of the study. The present study has found differences in perception of mathematics classroom environment and mathematics intrinsic motivation across departments. Thus future study should examine pertinent factors related to major courses taken.

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Appendix-I

A. Table: Means, Standard Deviations, and Bivariate Correlations of Variables for Computer science students

Variable	Mean	Std. Deviation	Pearson Correlations					
			1	2	3	4	5	6
1. MAch	1.6755	.84701	-					
2. MIM	3.6061	.57202	.382(**)	-				
3. PMCE	3.4106	.59182	.363(**)	.563(**)	-			
4. T-S _c	3.2591	.66892	.312(**)	.528(**)	.915(**)	-		
5. TSCS	3.4869	.71842	.295(**)	.393(**)	.850(**)	.709(**)	-	
6. SE	3.4859	.67456	.333(**)	.541(**)	.819(**)	.662(**)	.469(**)	-

** Correlation is significant at the 0.01 level (2-tailed), N = 124

B. Table: Means and Standard Deviations of PMCE, MIM, and MAch scores by sex for Computer Science students

Variable	Sex	N	Mean	Std. Deviation	t _{cal}	p
PMCE	Male	80	3.4969	.53740	2.223	.028
	Female	44	3.2539	.65750		
MIM	Male	80	3.6829	.59055	2.041	.043
	Female	44	3.4666	.51415		
MAch	Male	80	1.9046	.81988	4.348	.000
	Female	44	1.2589	.73616		

df = 122, 2-tailed, $\alpha = .05$, $t_{cr} = 1.980$

C. Table: Step-wise regression statistics for SE and T-S_c on mathematics intrinsic motivation science first year students

Model	Variable	B	β	t	p	R	R ²	F	p
1 (df1=1, df2=235)	Constant	1.535		8.715	.000	.622	.386	147.955	.000*
	SE	.584	.622	12.164	.000				
2 (df1=2, df2=234)	Constant	1.422		7.664	.000	.629	.395	76.456	.000*
	SE	.513	.546	8.382	.000				
	T-S _c	.108	.121	1.851	.065				

*p<.05

The regression equations for models 1 and 2 are respectively:

$$Y = 1.535 + 0.584X_1 \quad \text{and} \quad Y = 1.422 + 0.513X_1 + 0.108X_2$$

D. Table: Descriptive Statistics

Group	Variable	Minimum	Maximum	Mean	Std. Deviation
All Participants N = 237	MIM	1.21	4.95	3.6460	.58867
	PMCE	1.83	4.79	3.5524	.57183
	MAch	.00	4.00	2.1214	.96241
Computer Science N = 124	MIM	1.21	4.79	3.6061	.57202
	PMCE	1.83	4.63	3.4106	.59182
	MAch	.00	4.00	1.6755	.84701
Statistics N = 62	MIM	1.53	4.95	3.7479	.64461
	PMCE	2.71	4.79	3.8206	.48142
	MAch	1.00	4.00	2.7419	.81970
Earth Science N = 51	MIM	2.32	4.42	3.6192	.55327
	PMCE	2.29	4.42	3.5711	.50945
	MAch	.67	4.00	2.4512	.84006

Note: MIM=Mathematics Intrinsic Motivation

PMCE= Perception of Mathematics Classroom Environment

MAch=Mathematics Achievement

E. Yamane's (1967) formula to calculate sample size

$$n = \frac{N}{1 + N (\alpha)^2}$$

and

$$n_i = \frac{N_i \times n}{N},$$

where N= population size

n= sample size

α = level of significance

N_i = size of i^{th} stratum

n_i = number of participants selected from the i^{th} stratum

Appendix -II
Addis Ababa University
College of Education
School of Graduate Studies
Department of Psychology

Questionnaire to be filled by students

Dear Participant,

This questionnaire is designed to collect data for a research to be conducted in partial fulfillment of the requirement for a master's degree in Psychology with specialization in Measurement and Evaluation. Your honest and genuine responses to the given items are highly valuable for the study. Moreover, the completion of the study is based on your cooperation and information. Therefore, I ask your cooperation to give your honest and genuine responses to the following items.

All information, you provide, will be kept confidential and will be used only for the research purpose. If you decide not to participate in the study please return the questionnaire to the supervisor/investigator.

The investigator
THANK YOU IN ADVANCE!

Part I General Information about the Participant

Full Name.....

Sex: Male Female Age:Department:Section.....

Maths College Entrance Exam result:/100.

Part II Student's Perception of Maths Classroom Environment Questionnaire

Direction: Read each of the following statements carefully and choose one of the given alternatives on the basis of the extent to which each sentence best describes your feeling about your maths classroom environment. There is no right or wrong answer; simply, indicate your choice by marking "✓" under the alternative that you have chosen just in front of each sentence.

Item No	Item	Response categories				
		Not at all true	Not true	Neither true nor false	True	Very true
1	When my instructor lectures, he/she looks at me to maintain my attention.					
2	My instructor tells us that we can solve all the problems in our exercises.					
3	I'm not well organized in maths classes.					
4	I can freely ask my instructor while he/she is lecturing.					
5	My instructor doesn't care about how I do in maths.					
6	My instructor doesn't initiate me to ask in class.					
7	I don't always follow my maths instructor.					
8	I'm afraid to raise my hand in class.					
9	I have difficulty to try maths class works.					
10	My instructor doesn't give feedback for assignments and tests on time.					
11	My instructor and I care about each other.					
12	When I ask question, my instructor helps me clarify my question rather than directly answer.					
13	I think about maths between class meetings.					
14	I go to the instructor's office hours to review assignments or tests or to ask questions.					
15	My instructor likes the other students in my class better than me.					
16	I find ways to make the maths I learn relevant to my life.					
17	My instructor is interested in what I think, feel, and in what I do.					
18	My instructor assists me when I try class works.					
19	My instructor interrupts me when I have something to say.					
20	I don't come to maths classes always.					
21	My instructor listens to me.					
22	I try very hard to participate in maths classes.					
23	I do only some of the homework problems.					
24	My instructor doesn't like students who ask frequently in class.					

Part III Maths Intrinsic Motivation Inventory

Direction: Read each of the following statements carefully and choose one of the given alternatives on the basis of the extent to which each sentence best describes your feeling about your maths intrinsic motivation. There is no right or wrong answer; simply, indicate your choice by marking “√” under the alternative that you have chosen just in front of each sentence.

Item No	Item	Response Categories				
		Not at all true	Not true	Neither true nor false	True	Very true
1	I like to learn more about maths.					
2	I put a lot of effort into maths.					
3	I think I did pretty well at maths, compared to the other students.					
4	Learning maths didn't hold my attention at all.					
5	I like difficult problems because I enjoy trying to figure them out.					
6	I give up easily when I don't understand a maths problem.					
7	I felt pretty skilled at solving maths problems.					
8	I thought learning maths was very boring.					
9	I like to go on to new maths problems that are at a more difficult level.					
10	I don't finish doing maths homework at a time.					
11	I think I'm pretty good at maths.					
12	I enjoyed doing maths problems very much.					
13	When maths class work is given, I try to do only the easy ones.					
14	I always exercise maths because I am interested in the course.					
15	I'm not satisfied with my maths performance.					
16	I like to do as much exercise as I can in maths.					
17	Maths is a course that I couldn't do very well.					
18	I like hard work in maths because it is a challenge.					
19	I didn't try very hard to do well at maths.					

Appendix-III

በአዲስ አበባ ዩኒቨርሲቲ

የሥነ-ትምህርት ኮሌጅ

የድህረ-ምረቃ ፕሮግራሞች ትምህርት ቤት

የሥነ-ልቦና (ሳይኮሎጂ) ትምህርት ክፍል

በተማሪዎች የሚሞላ የፅሁፍ መጠይቅ

ውድ የጥናቱ ተሳታፊ፡-

ይህ የፅሁፍ መጠይቅ የተዘጋጀው በሥነ-ልቦና (Psychology) ትምህርት በተለይ ደግሞ በአብይ ጥናቱ በምዘናና ግምገማ (Measurement and Evaluation) ለሁለተኛ ዲግሪ (Master's Degree) ማሟያ የሚሆን ምርምር ለማካሄድ የሚያገለግል መረጃ ለመሰብሰብ ታስቦ ነው። እርስዎ ለተጠየቁት ጥያቄዎች የሚሰጡት ታማኝና ቅን ምላሽ ለጥናቱ ያለው ዋጋ በጣም ክፍተኛ ነው። በተጨማሪም የጥናቱ ሂደትና መጠናቀቅ በእርስዎ ትብብርና መረጃ ላይ የተመሰረተ ነው። ስለሆነም ለሚከተሉት ጥያቄዎች ታማኝና ቅን ምላሽ በመስጠት እንዲተባበሩን በትህትና እጠይቃለሁ። እርስዎ የሚሰጡት መረጃ ሁሉ ምስጢርነቱ የሚጠበቅ ከመሆኑም በላይ ጥቅም ላይ የሚውለውም ለዚህ ምርምር ስራ ብቻ ይሆናል። ይሁን እንጂ እርስዎ በጥናቱ ላለመሳተፍ ከወሰኑ መጠይቁን ለአስተባባሪዎች ወይም ለአዘጋጁ እንዲመልሱ በአክብሮት እጠይቃለሁ።

ለሚደረግልኝ ትብብር በቅድሚያ አመሰግናለሁ!

አዘጋጁ

ክፍል I የተሳታፊው አጠቃላይ መረጃ

ሙሉ ስም.....

የታ:- ወንድ ሴት ዕድሜ.....

ዲፓርትመንት.....ክፍል (ሴክሽን).....

የሒሳብ የ12ኛ መልቀቂያ ፈተና ውጤት:-...../100።

ክፍል II የተማሪ የሒሳብ ትምህርት ክፍለ-ጊዜ የግንዛቤ መጠይቅ

መመሪያ፡- የሚከተሉትን ገላጭ ዐረፍተ ነገሮች በጥንቃቄ ካነበቡ በውኃላ ከተሰጡት አማራጮች ውስጥ ዐረፍተ ነገሮቹን በሒሳብ ክፍለ-ጊዜ ላይ የሚኖርዎትን የግንዛቤ መጠን መሰረት በማድረግ ከአማራጮቹ አንዱ እንዲመርጡ በአክብሮት እጠይቃለሁ። ትክክል ወይም ስህተት የሚባል መልስ ስለሌለ በመረጡት አማራጭ ስር በዐረፍተ ነገሩ ፊት ለፊት ይህንን "✓" ምልክት ያድርጉ።

ተ.ቁ.	የዐረፍተ ነገር ዝርዝር	የመልስ አማራጮች				
		በፍፁም እውነት አይደለም	እውነት አይደለም	እውነትም ውሸትም አይደለም	እውነት	በጣም እውነት
1	አስተማሪዬ ሲያስተምሩ በትኩረት እንድከታተል ወደ እኔ ይመለከታሉ።					
2	አስተማሪያችንን መልመጃዎች ላይ ያሉትን ጥያቄዎች በሙሉ እንድንሰራ ያበረታቱናል።					
3	በሒሳብ ክፍለ-ጊዜያት በተሟላ ሁኔታ አልዘጋጅም።					
4	አስተማሪዬ ሲያስተምሩ ያለ ምንም መሸማቀቅ መጠየቅ እችላለሁ።					
5	ሒሳብ ላይ እንዴት እንደምሰራ አስተማሪዬ አይጨነቁበትም።					
6	በክፍል ውስጥ እንድጠይቅ አስተማሪዬ አያነሳሱኝም።					
7	የሒሳብ አስተማሪዬ ሲያስተምሩ ሁል ጊዜ አልከታተላቸውም።					
8	በክፍል ውስጥ እጄን ለማንሳት እፈራለሁ።					
9	የሒሳብ የክፍል ስራዎች ለመሞከር እቸገራለሁ።					
10	አስተማሪዬ ለሚሰጡን ስራዎችና ሙከራዎች ግብረ መልስ በወቅቱ አይሰጡም።					
11	እኔና አስተማሪዬ ስለ እያንዳንዳችን እንተሳሰባለን።					

ተ.ቁ.	የዐረፍተ ነገር ዝርዝር	የመልስ አማራጮች				
		በፍፁም እውነት አይደለም	እውነት አይደለም	እውነትም ውሽትም አይደለም	እውነት	በጣም እውነት
12	አስተማሪዬ በቀጥታ መልስ ከመስጠት ይልቅ ጥያቄዬን እንደብራራ ይረዳኛል።					
13	በያንዳንዱ ክፍለ-ጊዜ መሀል ስለ ሒሳብ ትምህርት አስባለሁ።					
14	አስተማሪዬ በቢሮ በሚገኙባቸው ሰዓቶች የቤት ስራዬን ወይም ሙከራዎቼን ለመከለስ ወይም ለመጠየቅ ወደ ቢሮአቸው እሄዳለሁ።					
15	አስተማሪዬ ከኔ ይልቅ ሌሎች የክፍሉ ተማሪዎችን ይወዳሉ።					
16	የምሚረውን ሒሳብ ከኑሮዬ ጋር ለማዛመድ መንገዶችን እፈልጋለሁ።					
17	አስተማሪዬ እኔ በማስበው፣ በሚሰማኝና በምሰራው ደስተኛ ናቸው።					
18	የክፍል ስራ ስሞክር አስተማሪዬ ይረዳኛል።					
19	አንድ ነገር ለመናገር ስፈልግ አስተማሪዬ ያቋርጡኛል።					
20	ወደ ሒሳብ ክፍል ሁልጊዜ አልመጣም።					
21	አስተማሪዬ ያዳምጡኛል።					
22	በሒሳብ ክፍሉ-ጊዜዎች ለመሳተፍ በጣም ጠንክራ እሞክራለሁ።					
23	ከቤት ስራ ጥያቄዎቼ ውስጥ ጥቂቶቼ ብቻ እሰራለሁ።					
24	አስተማሪዬ አዘውትሮ የሚጠይቁ ተማሪዎችን አይወዱም።					

ክፍል III የሒሳብ ትምህርት እውነተኛ/ውስጣዊ መነሳሳት ዝርዝር ዐረፍተ ነገር

መመሪያ፡- የሚከተሉትን ዝርዝር ዐረፍተ ነገራት በጥንቃቄ ካነበቡ በውኃላ ከተሰጡት አማራጮች ውስጥ ዐረፍተ ነገሮቹን ለሒሳብ ትምህርት ያሉትን የውስጣዊ መነሳሳት መጠን መሰረት በማድረግ ከአማራጮቹ አንዱ እንዲመርጡ በአክብሮት እጠይቃለሁ። ትክክል ወይም ስህተት የሚባል መልስ ስለሌለ በመረጡት አማራጭ ስር በዐረፍተ ነገሩ ፊት ለፊት ይህንን "J" ምልክት ያድርጉ።

ተ.ቁ	የዐረፍተ ነገር ዝርዝር	የመልስ አማራጮች				
		በፍፁም እውነት አይደለም	እውነት አይደለም	እውነትም ውሸትም አይደለም	እውነት	በጣም እውነት
1	ስለ ሒሳብ ብዙ መማር እወዳለሁ።					
2	በሒሳብ ትምህርት ላይ ከፍ ያለ ጥረት አደርጋለሁ።					
3	ከሌሎች ተማሪዎች አንጻር ሒሳብ ላይ በጣም ጥሩ የሰራሁ ይመስለኛል።					
4	ሒሳብ መማር በፍፁም ትኩረቴን ሊስበው አልቻለም።					
5	ከባድ የሒሳብ ጥያቄዎችን እወዳለሁ ምክንያቱም በደንብ እስኪገቡኝ ስለነሱ ማሰብ ያዝናኛል።					
6	የሒሳብ ጥያቄ ሳይገባኝ ሲቀር በቀላሉ ጥረቴን አቆማለሁ።					
7	የሒሳብ ጥያቄዎችን ለመስራት ከፍተኛ ችሎታ እንዳለኝ ይሰማኛል።					
8	ሒሳብ መማር በጣም አሰልቼ ይመስለኛል።					
9	ደረጃቸው ከፍ እያሉ በሚሄዱ አዳዲስ የሒሳብ ጥያቄዎች ላይ መቀጠል ደስ ይለኛል።					
10	የሒሳብ የቤት ሥራዬን መስራት ባንዴ አልጨርስም።					

ተ.ቁ	የዐረፍተ ነገር ዝርዝር	የመልስ አማራጮች				
		በፍፁም እውነት አይደለም	እውነት አይደለም	እውነትም ውሸትም አይደለም	እውነት	በጣም እውነት
11	በሒሳብ ጎበዝ እንደሆንኩ ይሰማኛል።					
12	የሒሳብ ጥያቄዎችን መስራት በጣም ያዝናናኛል።					
13	የሒሳብ የክፍል ስራ ሲሰጥ ቀላል ጥያቄዎችን ብቻ ለመስራት እጥራለሁ።					
14	ሒሳብን ሁልጊዜ እሰማመዳለሁ ምክንያቱም በትምህርቱ ፍላጎት አለኝ።					
15	በሒሳብ ውጤቱ አልረካሁም።					
16	አቅሜን በፈቀደው ሁሉ ሒሳብን መለማመድ ደስ ይለኛል።					
17	ሒሳብ በጥሩ ሁኔታ የማልሰራው ትምህርት ነው።					
18	በሒሳብ ላይ ጠንክሮ መስራት የምፈልገው ልዩ ችሎታን የሚጠይቅ በመሆኑ ነው።					
19	በሒሳብ ላይ ጠንክራ ለመስራት አልጥክርኩም።					

Declaration

This thesis is my original work and to my best knowledge it has not been conducted by any other writer. All of the information that is taken from other sources is duly acknowledged.

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Signature -----

Date *24 June 2009*-----

Confirmed by Advisor

Name *Seleshi Zeleke* (PhD)

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Date *24 June 2009*-----