THE CONNECTION BETWEEN SCHOOL AND STUDENT CHARACTERISTICS WITH MATHEMATICS ACHIEVEMENT IN TURKEY

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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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ABSTRACT

THE CONNECTION BETWEEN SCHOOL AND STUDENT CHARACTERISTICS WITH MATHEMATICS ACHIEVEMENT IN TURKEY

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The purpose of study is to investigate the effects of school characteristics on students' mathematics achievement across Turkey by analyzing the data collected from school questionnaire, student background questionnaire and mathematics achievement test in Trends in International Mathematics and Science Study 2007. The analyzed sample was comprised of 4,498 students in 146 schools. Student level factors were highest level of education of either parent, students speak the language of test at home, students' parents born in country, books in home, computer and internet connection, computer use, index of time students spend doing mathematics homework in a normal school week, index of students' positive affect toward mathematics, index of students' valuing mathematics, index of students' self confidence in learning mathematics. School related factors were principals reports on the percentages of students in their schools coming from economically disadvantaged homes, principals report on the percentage of students having the language of test as their native language, index of good attendance, principals time spent on various school related activities, schools encouragement of parental involvement, index of school resources for mathematics instruction, index of principals perception of school climate.

Hierarchical Linear Modeling (HLM) was used for analysis. The result of the study showed that 45% of variance between schools, 54.6 % of variance was in schools, 57.33 % of school variance in mathematics achievement accounted by principals' report on percentages of students coming from economically disadvantaged homes, parents to volunteer for school programs, school resources for mathematics instruction and principals' perception of school climate.

Key Words: Trends in International Mathematics and Science Study (TIMSS 2007), Mathematics Achievement, Hierarchical Linear Modeling (HLM), School Related Factors, Student Related Factors, Turkey.

ÖZ

TÜRKİYE'DE OKUL VE ÖĞRENCİ ÖZELLİKLERİNİN MATEMATİK BAŞARISI İLE İLİŞKİLERİ

Sevgi, Sevim

Yüksek Lisans, Orta Ögretim Fen ve Matematik Alanları Egitimi Bölümü
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Bu çalışmanın amacı Türkiye'deki okul özelliklerinin örgencilerin matematik başarısına etkisini, 2007 Uluslararası Matematik ve Fen Yönelimleri Çalışmasında kullanılan (TIMSS 2007) okul anketi ve öğrenci özgeçmiş anketi ve matematik başarı testi verilerini kullanarak incelemektir. Çalışmanın örneklemi 146 okuldaki 4498 öğrenciden oluşmaktadır. Öğrenci değişkenleri velilerin eğitim seviyesi, evde konuşulan dil, veliler ülkede doğmuş, evdeki kitap sayısı, bilgisayar ve internet bağlantısı, bilgisayar kullanımı, normal okul haftasında öğrencilerin ödev yapmak içi harcadığı zaman indeksi, matematiğe yönelik öğrencilerin pozitif tutum indeksi, öğrencilerin matematiğe verdikleri değer indeksi, öğrencilerin matematik öğrenimindeki öz-güven indeksinden oluşmaktadır. Okul değişkenleri okul yöneticilerinin rapor ettiği düşük ekonomik seviyeli ailelerden gelen öğrencilerin yüzdesi, okul yöneticilerin anketin dili ana dili olan öğrencilerin yüzdesini verdiği rapor, düzenli devam indeksi, okul yöneticilerinin çeşitli okul etkinliklerine harcadıkları zaman, okulun veli katılımını teşviki, matematik öğretimi için kullanılan okul araç-gereç indeksi, okul yöneticilerinin oluşturduğu okul ortamı indeksinden oluşmaktadır.

Hiyerarşik doğrusal modelleme analizler için kullanılmıştır. Çalışmanın sonucu sapmanın yüzde 45'nin okullar arasında, yüzde 54,6'sının okulların içinde, yüzde 57.33 matematik başarısını etkileyen okul degişkenlerinden, okul yöneticilerinin rapor ettiği ekonomik olarak düşük ailelerden gelen öğrencilere, velilerin okul programlarında gönüllü olmasına, matematik öğretimi için okulda bulunan kaynaklara, okul yöneticilerinin rapor ettigi okul ortamına bağlı olarak değiştiğini göstermiştir.

Anahtar Kelimeler: Uluslararası Matematik ve Fen Eğilimleri Çalışması (TIMSS 2007), Matematik Başarısı, Hiyerarşik Doğrusal Modelleme (HLM), Okul Degişkenleri, Öğrenci Değişkenleri, Türkiye

To my family

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TIMSS 2007: Third International Mathematics and Science Study 2007

HLM: Hierarchical Linear Modeling

IEA: International Association for the Evaluation of Educational Achievement

CHAPTER 1

INTRODUCTION

This research attempts to get an understanding of the school level factors and their interactions on students' mathematics achievement across Turkey through the Trends in International Mathematics and Science Study (TIMSS) 2007 which was conducted by IEA.

Education is a complex process which is an interaction of many variables. To understand a dynamic system such as education, it is important to depict it in a way that allows for linkages among components of the system to be ascertained and evaluated. These variables affect how much learned. Policymakers and educators in many countries around the world recognize that family, school, and community each has an important role in the process of educating children and has adopted policies to involve schools, students, administrators, teachers, parents in children's education (Kelley-Laine, 1998).

School has an important portion for students' achievement since students have completed their instruction at that environment. Environment of the school, as school climate, and the components of the instruction affect students. Basic lessons like literature, mathematics, science were not liked by students. Mathematics is one of these courses and students are generally unsuccessful at that lesson. The reasons of that failure might be originated form the school components. These school components are principals, duties of principals, school climate, SES of school. Ramirez (2006), Campbell and Abbot 2006), Chernickovsky (1985), Lee & Smith (1995) Lee and Loab (2000) examined these school characteristics and the researches showed that school characteristics affected students mathematics achievement.

Students’ mathematics achievement is often associated with future economic power of a country (Baker & LeTendre,2005; Wobmann, 2003 as cited Phan, 2008). The desire to build an effective educational model that can improve students’ mathematics achievement has been commonly shared among national leaders and policy makers, as well as educators around world (Phan, 2008).
Mathematics is a difficult area for students so students’ achievement levels are lower than the other subject areas. Because of that reason, mathematics achievement and factors affecting mathematics achievement are attracted by the researchers.

In view of the importance of imparting mathematical knowledge and thinking skills for establishing a nation’s competitive advantage in an increasingly global economy, education systems in many countries are concerned about their students’ performance in international tests and are seeking means for improving mathematics instruction (Wagemaker, 2002). To see nations, strengths and weakness international studies are important as TIMSS, PISA, PIRLS. These studies collects detailed knowledge related to students background, school and teacher. Three levels collected knowledge are important for nested analysis. These three levels affect each other.

As Philips (1997) and many researchers contend that shared values and activities positive adult social relations, positive teacher-student relations, and democratic governance enhance students' school engagement and their academic achievement.

These factors were categorized as home background, school, family, and education level of family, perceived value of mathematics, attitudes toward mathematics, self concept, learning experiences, self-efficacy, and interest. In this study, factors affect students’ mathematics achievement examined in five categories as home background, home-school interface, school size and location, school social climate, instructional activities in mathematics class.

Academic achievement at any point is a cumulative function of current and prior family, community, and school experiences. A study of the entire process would require complete family, community, and school histories. A vast array of characteristics and constructs that have been shown to influence achievement: attitude (Ma, 1997), beliefs (Kloaasterman, 1995, Schoenfeld, 1985, Garafalo, 1989), gender (Benbow & Stanley, 1980; Fennema & Carpenter, 1981), parent education (Ethington, & Wolfe, 1984; Ma, 1997, Meece et al., 1982; Tasi & Walberg, 1983), employment (Greenberger & Steinberg, 1986), homework (Keith and Cool, 1992) and school size (Lee & Smith, 1997).

Leadership, organization and management are identified as important factors by school effectiveness researchers, whilst school improvement researchers (see Gray et al., 1999) have concentrated on decision-making, within-school hierarchy and communication. Recent findings in school effectiveness studies (see e.g., Sammons. 1999; Teddlie & Reynolds, 2000) show that school-level factors influence achievement far less than do factors at the class-level. (Howie 2003 den)

The World Bank (1995) lists libraries, time on task, homework, textbook provision, teacher knowledge, teacher experience, laboratories, teacher salaries and class size as important for effective schooling in developing countries. Other influential factors found are teacher expertise and competence, strong leadership, clear organization of the school day and the learning program (time and opportunity) and community and parental involvement in school governance (Muller & Roberts, 2000)

The influencing factors of mathematics achievement are different and specific for each participating country. A systematic analysis of TIMSS 1999 indicated that teacher education, the frequency of assigning homework, and school autonomy improve the students' achievement. Mathematics achievement depends mainly on mathematics curriculum contents, school equipment, use of computer and calculator in teaching and learning, mathematics teachers' preparation and experience, students' motivation and their level of educational aspiration, parents' educational level, etc.

1.1 Trends in International Mathematics and Science Study

TIMSS, Trends in International Mathematics and Science Study, is designed to assist countries all over the world to improve student learning in mathematics and science. It collects educational achievement data at the fourth and eighth grades to provide information about trends in performance over time together with extensive background information to address concerns about the quantity, quality, and content of instruction.

TIMSS provides important information for policy development, to foster public accountability, to allow areas of progress or decline in achievement to be identified and monitored, and to address concerns for equity.

Over 60 countries from all over the world participate in TIMSS. A project of the IEA headquartered in Amsterdam, it is directed by the TIMSS International Study Center at Boston College in collaboration with a worldwide network of organizations and representatives from the participating countries.

1.2 Trends in International Mathematics and Science Study 2007

TIMSS was continuing cycle of international mathematics and science assessments conducted every four years as; the first round of TIMSS was in 1995 and the second in 1999, third round in 2003, fourth round was TIMSS 2007 TIMSS assesses achievement in countries around the world and collects a rich array of information about the educational contexts for learning mathematics and science, with TIMSS 2007 involving more than 60 participants. The participating countries to TIMSS 2007 were: Algeria, Armenia, Australia, Austria, Bahrain, Bosnia and Herzegovina, Botswana, Bulgaria, Chinese Taipei, Colombia, Cyprus, Czech Republic, Denmark, Egypt, El Salvador, England, Georgia, Germany, Ghana, Hong Kong SAR, Hungary, Indonesia, Iran, Islamic Rep. of, Israel, Italy, Japan, Jordan, Kazakhstan, Korea, Republic of, Kuwait, Latvia, Lebanon, Lithuania, Malaysia, Malta, Mongolia, Morocco, Netherlands, New Zealand, Norway, Oman, Palestinian National Authority, Qatar, Romania, Russian Federation, Saudi Arabia, Scotland, Serbia, Singapore, Slovak Republic, Slovenia, Sweden, Syrian Arab Republic, Thailand, Tunisia, Turkey, Ukraine, United States of America, Yemen and benchmarking participants: Alberta *(Canada)*, Basque Country *(Spain)*, British Columbia *(Canada)*, Dubai *(United Arab Emirates)*, Massachusetts *(United States)*, Minnesota *(United States)*, Ontario *(Canada)*,Quebec *(Canada).*

TIMSS 2007 was initiated with the first National Research Coordinators (NRCs) meeting, in February 2005. Instrument development and field test activities has been carried out between February 2005 and April 2006. Data collection for the main survey has been conducted in October–December 2006 (Southern Hemisphere) and April–May 2007 (Northern Hemisphere). The International Reports for grades fourth and eight will be released in December 2008, and the International Data Base and User Guide will be available in March 2009

As previous TIMSS assessments, TIMSS 2007 is coordinated by the IEA International Study Center located at Boston College, United States. The study Co-directors are Dr Michael Martin and Dr Ina Mullis. Other members of the TIMSS 2007 consortium are the IEA Secretariat and the IEA Data Processing Center, Statistics Canada, and the Educational Testing Service

The international management of TIMSS 2007 project is funded by the participating countries with support from the World Bank, the United States Department of Education through the National Center for Education Statistics, and the United Nations Development Programme (taken from the web site of

1.3 Scales for Student Mathematics Achievement in TIMSS

TIMSS 2007 mathematics assessment was organized around two dimensions, a content dimension specifying the subject matter domains to be assessed within mathematics and a cognitive dimension specifying the thinking processes or domains to be assessed. At the eighth grade, the four content domains are number, algebra, geometry, and data and chance. The mathematics framework describes each content domain in terms of the specific topic areas covered and the objectives within each topic. The cognitive domains are the same for both grades—knowing, applying, and reasoning. Each cognitive domain is described according to the sets of processing behaviors expected of students as they engage with the mathematics content. The emphasis across the cognitive domains is such that the majority of the items assess the applying or reasoning domains. The eighth grade the test includes 215 items totaling 238 score points. At both grades, approximately half the items are constructed-response and half are multiple-choice.

To describe student performance at various points along the TIMSS mathematics and science achievement scales, TIMSS 2007 used scale anchoring to summarize and describe student achievement at four points on the mathematics and science scales—Advanced International Benchmark (625), High International Benchmark (550), Intermediate International Benchmark (475), and Low International Benchmark (400) (Olsan et all., 2008).

1.4 Implementing TIMSS

TIMSS 2007 was a collaborative effort involving hundreds of individuals around the world. TIMSS 2007 has spanned approximately five years and has involved so many people and organizations. TIMSS is a major undertaking of IEA, and together with PIRLS, comprises the core of IEA's regular cycle of studies. PIRLS, which regularly assesses reading at the fourth grade, complements the TIMSS assessments. The TIMSS & PIRLS International Study Center at Boston College has responsibility for the overall direction and management of the TIMSS and PIRLS projects. Headed by Drs. Michael O. Martin and Ina V.S. Mullis, the study center is located in the Lynch School of Education. In carrying out the project, the TIMSS & PIRLS International Study Center worked closely with the IEA Secretariat in Amsterdam, which provided guidance overall and was responsible for verification of all translations produced by the participating countries. The IEA Data Processing and Research Center in Hamburg was responsible for processing and verifying the internal consistency and accuracy of the data submitted by the participants. Statistics Canada in Ottawa was responsible for school and student sampling activities. Educational Testing Service (ETS) in Princeton, New Jersey provided psychometric methodology recommendations addressing calibration, scaling, and survey design changes implemented in TIMSS 2007, and assisted in executing the item calibration analyses and made available software for scaling the achievement data (Olsan et. all, 2008). In Turkey, The Ministry of National Education (MONE), Educational Development and Research Directorate (ERDD) implements TIMSS April 2007. Turkish 8th grade 13-14 years old student population was represented by the sample of 4498 students in TIMSS 2007.

1.5 Purpose of the Study

In fact, Turkey is a low performing country among the participants of TIMSS countries. The rank of Turkey is 37 among 60 participant countries which was below the international average. The study intends to search the factors affecting mathematics achievement among Turkish students.

This quantitative study attempts to answer a multifaceted question. The aim of the study was to gain a complete understanding of student and school level factors that influence students' mathematics achievement. The school level factors were school climate, instructional time, school goals, and resources available to support mathematics instruction, home-school connection.

Following research questions were analyzed by using hierarchical linear modeling. Each question was analyzed for mathematics achievement separately.

i. Which school factors have significant effect on the mathematics achievement of the students across Turkey by using TIMSS 2007 data?

ii. What proportion of variance in mathematics achievement is explained by school related factors?

1.6 Significance of the Study

To catch the improvisations throughout the world, education systems and curriculums modernize by policy makers in each country according to education policy of country and in the light of aims of national education. In Turkey, mathematics curriculums renewed at 2004. Teachers who implement these changes of curriculum at schools show some differences between them. Teacher characteristics and differences affect mathematics achievement of students in a negative way or in a positive way. The study intended to analyze school characteristics in terms of mathematics achievement while student characteristics were controlled. That question would be answered: “Which school characteristics are effecting students’ mathematics achievement?”

TIMSS 2007 data were used to analyze students’ mathematics achievement. That data set was important since the latest international survey which Turkey participated in. The study was a secondary analysis of TIMSS 2007 to examine affects of school characteristics on mathematics achievement. The variance in student achievement between schools and within schools on mathematics achievement is for Turkey in TIMSS 2007. Analysis of the study was also significant since hierarchical analysis techniques permit multiple covariates statistically controlled within same analysis. In the analyses but teacher and school characteristics were used to predict students’ mathematics achievement. Hierarchical linear modeling was used to analyze multiple regressions.

The results of research would be helpful for students, teachers, schools, parents and policy makers to improving students’ mathematics achievement. The results can be used to support our children for their attitudes for mathematics and teachers and school for modifying school settings, and adapting teaching activities, policy makers for resource allocation.

1.7 Definition of Terms

1.7.1 School Related Terms

1. *School Demographics*: School size, its location, and characteristics of its student body impact how the school system works.
2. *School Organization*: Whether as part of a larger national, regional, or local education system or because of decisions made at the school level, science and mathematics instruction is carried out within certain organizational constraints.
3. *School Goals*: schools identify and communicate ambitious but reasonable goals and work toward implementing them.
4. *Roles of School Principal*: Roles of school principal include ensuring that the school, its operation, and its resources are managed optimally. The principal may guide the school in setting directions, seeking future opportunities, and building and sustaining a learning environment. He or she can facilitate the development, articulation, implementation, stewardship, and evaluation of a model of learning that is shared and supported by the school community.
5. *Resources available to support mathematics instruction*: General resources include teaching materials, budget for supplies, school buildings and supplies, heating/cooling and lighting systems, and classroom space. Subject-specific resources for mathematics and science may include computers, computer software, calculators, laboratory equipment and materials, library materials, and audio-visual resources.
6. *Technology, Support and Equipment:* The effective and efficient use of computers requires suitable training of teachers, students, and school staff. Use of computers can also be enhanced by providing access to the internet for educational purposes.
7. *School climate:* A school's social climate comprises the values, cultures, safety practices, and organizational structures that cause it to function and react in particular ways. Respect for individual students and teachers, a safe and orderly environment, constructive interactions among

administrators, teachers, parents, and students all contribute to a positive school climate.

8. *Parental Involvement*: Parental involvement can be in the areas of checking homework, volunteering for field trips, and fund raising. Parents also can get involved in the decision-making or administrative processes of the school (e.g., selecting school personnel, reviewing or making decision for school finances, etc.).
9. *Teacher recruitment:* Employment contracts, incentives such as free college education, attractive pay, housing facility, and giving bonuses to deserving teachers are some of the methods used to recruit suitable candidates.
10. *Teacher Evaluation*: One way is observation of their teaching by the principal, inspectors or senior member of the staff. Some of other methods that can be used for evaluating teachers quality are student achievement and teacher peer review.

1.7.2 Student Related Factors

1. *Home Background*: Students come to school from different backgrounds and with different experiences. The number of books in the home, availability of a study desk, the presence of a computer, the educational level of the parents, and the extent to which students speak the language of instruction have been shown to be important home background variables, indicative of the family's socio-economic status.
2. *Attitudes*: Students' motivation to learn can be affected by whether they find the subject enjoyable, place value on the subject, and think it is important in the present and for future career aspirations. Students' motivation can be affected by their self confidence in learning the subject.

1.7.3 Hierarchical Linear Modeling Terms

1. *Mathematics Achievement:* Mathematics achievement in TIMSS 2007.
2. *Conditional or residual variance-covariance β_{0j}, β_{1j}*: The values of the level-2 variances and covariance after level-2 predictors have been added for β_{0j} and $\beta_{1j.}$
3. *Fixed effects:* The only levels of a variable in which an experiment in interested in studying.
4. *Intra-class correlation coefficient:* The proportion of variance in the outcome that is between groups, $\rho = \tau_{00} / (\tau_{00} + \sigma^2)$.
5. *Means-as-outcomes regression model:* Form of a random-intercept model with only one random level-1 coefficient.
6. *One-way random-effects ANOVA model:* No level-1 and level-2 predictors.
7. *Outcome variable*: The level-1 dependent variable.
8. *Random-coefficients regression model:* All level-1 coefficients are allowed to vary randomly (unconditional at level-2).
9. *Random effects:* A subset of the total possible levels of a variable where the experimenter is interested in generalizing the two levels not observed.
10. *Unconditional variance-covariance β_{0j}, β_{1j}*: The values of the level-2 variances and co-variances based on the random coefficient regression model.
11. *Variable grand-mean centered:* Independent variables are centered on a ground mean by subtracting each participants' value on the independent variable from the mean of that variable across the mean of all other participants in the study.
12. *Variable group-mean centered:* Independent variables are centered on the mean of their level-2 group.
13. *Variable centered:* A dummy coded variable.

CHAPTER 2

LITERATURE REVIEW

This chapter devoted to the presentation of the previous research in the literature related to present study. The variables that are mostly studied in the school effectiveness are presented by giving prior studies about them. Firstly, studies about the TIMSS, then school related factors, school characteristics, role of principal, parental involvement, school climate, eight grade student behavior resources and technology, school size, student related factors, as student background characteristics and attitudes.

2.1 Studies about Trends in International Mathematics and Science Studies

A systematic analysis of TIMSS 1999 results and found that teacher education, the frequency of assigning homework, and school autonomy improves the students' performance. Disruptive students had a statistically significant negative relationship to the students' test results (Jürges and Schneider, 2004 cited in Mikk, 2006).

Hammouri (2004) scrutinized the effects of student-related variables on achievement in mathematics with the data of 3736 13-year-old Jordanian 8th-graders who participated in the TIMSS. Affective variables were educational aspiration, attitude, success attribution, confidence in ability and perception of importance of mathematics. A structural equation model was used to estimate and test the hypothesized relationships of the factors with achievement in mathematics. Results from this study indicated that four attitudinal and motivational variables had strong positive total and direct effects; and two variables had negative total and direct effects on mathematics achievement.

Birenbaum, Tatsuoka and Xin (2005) compared mathematics performance of eight grades from US, Singapore, Israel by applying a diagnostic model for large scale assessment to TIMSS. Comparisons were made on the mastery probabilities for content, skills and cognitive processes underlying students' performance and the proportions of students from these samples in each of eight hierarchically ordered clusters of knowledge states by using TIMSS 1999. The results were indicated significant results in the favor of Singaporean sample. U.S. and Israel had relative strength in most content and special skills but with considerable deficiency in mathematical thinking skills such as logical thinking pattern recognition, which involves inductive thinking, open ended item type, which involves divergent thinking, and data and procedure management. It appeared that the average student in the US and Israel is taught relatively well in content knowledge and special mathematics skills but not mathematical thinking skills. Singapore's students, on the other hand, are well taught in these skills as well as in content and special skills.

Mikk (2006) investigates the correlates and compares the values of the correlates for the Republic of Lithuania with the average TIMSS 2003 international values. The correlation analysis revealed a strong relationship between TIMSS results, and economic development of counties, teacher and parent education, the students' safety in schools, etc. Mathematics instruction time had no correlation with the TIMSS results in the countries with the higher TIMSS score but in Lithuania comparison revealed a positive relationship between these variables.

Antonijević (2004) examined the Serbian eighth grade students and the mathematics curriculum context of their achievement in the fields of mathematics by using TIMSS 2003. Serbian eighth graders placed in the zone of intermediate international benchmarking level by 477 points. Statistically significant difference was found in the mathematics achievement between girls and boys in the Serbian TIMSS 2003 sample, so the girls' average scale score was 480 points and the same value for the boys was 473 points. The achieved results raise many questions about the contents of mathematics curriculum in Serbia, its quality and basic characteristics of its implementation. Their results can be eligibly used to improve the mathematics curriculum and teaching in Serbian primary school.

Antonijević (2004) studied connectedness between using computers and calculators and students' achievement is especially explored and presented in the frame of students' sample in four countries, the United States, the Netherlands, Bulgaria and Serbia.

Using computers and calculators in teaching and its implications to students' overall achievement examined by using TIMSS 2003 data at the end of primary school education. The TIMSS 2003 international overall results in this area show that using computers in teaching doesn't significantly contribute to better students' achievement in the field of mathematics and also show some level of significant influence on students' achievement in the field of science. Moreover, the results show that using calculators in mathematics teaching improve overall students' achievement.

Ramirez (2006) investigated the likely causes for low performance of Chile in mathematics by using TIMSS 1999 data sets. Chile was compared to three countries which large school system that had similar economic conditions but superior mathematics performance, and examined how important characteristics of the Chilean educational system could account for poor student achievement in mathematics. The study finds that, compared to South Korea, Malaysia, the Slovak Republic, and Miami-Dade County Public Schools: Chilean 8th graders had parents with fewer years of schooling and with fewer educational resources at home; the Chilean mathematics curriculum covered less content and fewer cognitive skills; and the insufficient official curriculum translated into a weaker curricular implementation. Hierarchical linear models of Ramirez indicated that, school assets were unequally distributed across social classes, with schools in socially advantaged areas more likely to have their own mathematics curriculum and better prepared teachers who emphasized more advanced mathematics content. Schools with their own mathematics curriculum and whose teachers covered more advanced content had significantly higher student achievement in mathematics.

2.2 School Related Factors

The school effectiveness literature refers to several factors that may be helpful to understand why some schools attain higher achievement levels than others, with the broader social and economic context in which the schools operate, the curriculum, teacher quality, and school resources (Reynolds & Teddlie, 2000, as cited in Ramirez, 2006). Philips (1997) stated that school characteristics may affect not only the average level of attendance or achievement in a school but also the relationship between individual-level variables and attendance or achievement (within-school slopes) School related factor for the study was grouped as: school characteristics, role of principal, parental involvement, school climate for learning, eight grade instruction, eight grade teachers, student behavior, resources and technology.

2.2.1School Characteristics

Structural characteristics of the schools have important impact on the lives of the school members principals, administrators, teachers, students. The characteristics of schooling have an influence on students' achievement as a rule. Research covers the structural characteristics of the school as total school enrolment, of all grades, total school enrolment of eight grade, type of community, type of students' background of disadvantages, type of students' background of economic influence.

Some of researches stated that school location have an effect on the achievement of students, students who were living in rural areas posses high achievement levels that urban area students. Campbell and Abbot (1976) stated that children in larger villages and of the freehold and Barolong farms are more likely to be enrolled in school than children in rural areas. Chernickovsky (1985) also supported that findings children living in large villages, both those in school and those out of school have higher average levels than children living in small villages after controlling variables (age, sex, etc.)

School size was the second of school characteristics. Findings indicated that school size has an influence on student achievement directly or indirectly. Lee & Smith (1995) found that school size had a direct impact on achievement. Lee and Loeb (2000) examined teachers and students are influenced by the size of inner-city elementary school which they belong. Small schools are favored compared with medium-sized or larger schools. In small schools, teachers have a more positive attitude about their responsibility for students learning and students learn more. School size affects student achievement both directly and indirectly, through teacher attitudes.

SES has long been offered as a primary factor that contributes to differences in student academic achievement (Thomas, Sammons, Mortimore, & Smees, 1997 as cited in Ma, 2001). Ma and Klinger (2000) examined student background, school context, and school climate effects on Grade 6 student achievement in mathematics, science, reading, and writing by using HLM in New Brunswick School Climate Study were used to gender, socioeconomic status (SES), and native ethnicity were significant predictors of academic achievement. They found that, schools showed the smallest variation in reading, the largest in mathematics. Schools mean SES and disciplinary climate, school size and parental involvement was significant in mathematics.

2.2.2 Role of Principal

Anderson (2008) researched effectiveness of observable and quantifiable traits in and approaches of school principals in enchaining student achievement.

2.2.3 Parental Involvement

When parents are actively involved in their child's education, the results are increased student academic achievement and improved student attitudes (Fiala & Sheridan, 2003; Jones & White, 2000; Zellman & Waterman, 1998).
Goldring & Shapira (1996) explored the dynamics of purposeful leadership and parental involvement, two central components of effective schools. The results of four cases studies were presented that consider the ways in which principals work with parents in schools that had a shared, consistent mission. The case studies revealed that principal-parent interactions were the result of unique processes in each school and were negotiated and institutionalized over time.

Ho & Willms (1996) identified four dimensions of parental involvement and assessed the relationship of each dimension with parental background and academic achievement for a large representative sample of US middle school students. Schools varied somewhat in parental involvement associated with volunteering and attendance at meetings of parent- teacher organizations, they did not vary substantially in levels of involvement associated with home supervision, discussion of school related activities, or parent- teacher communication. School related activities at home had the strongest relationship with academic achievement. Parents' participation at school had a moderate effect on reading achievement but a negligible effect on mathematics achievement.

Zhao and Akiba (2007) examined the level of school expectation for various types of parental involvement in the US and South Korea and the relationship among school characteristics, expectations for parental involvement, and 8th grade students' mathematics achievement. They were used the TIMSS 1999 dataset. They showed that teacher collaboration and school disorder problems were two school factors associated with the level of school expectations for parental involvement in both countries. They also found that school expectations for parental involvement were significantly associated with higher student achievement in mathematics in the US but not in South Korea.

2.2.4 School Climate for Learning

Many investigations have revealed that the school climate influences educational achievement (Schmitt et al., 1999). Disruptive students had a statistically significant negative relationship to the students' test results (Jürges and Schneider, 2004, cited in the Mikk, 2006). Good classroom climate fosters teach (O'Dwyer, 2005).

Philips (1997) concluded that coefficient of teachers' caring for students is not only negative but reliably different from zero. Result suggested that students who attend schools in which teachers seem to care a lot about them tend to have higher mathematics achievement by the end of eighth grade than they would if they attended schools in which teachers apparently cared less. This may, however, just mean that schools in which students have fewer personal problems teach more mathematics. Students are less likely to be absent when they attend schools where a larger proportion of eighth graders take algebra and where teachers expect them to graduate from high school and college. Likewise, students learn more mathematics during middle school when they attend schools where students do more homework.

Akiba (2008) conducted secondary analyses of the TIMSS collected during 1999. The data from 33 countries were analyzed for the identification of individual predictors, and six selected countries were further analyzed for school-related predictors. The USA, Chile, Hungary, Israel, The Netherlands, and Taiwan were chosen based on their geographical, cultural, and sociopolitical representation of various regions around the world, their varying levels of student fear of school violence, and their differences in education and school systems, which will provide rich and diverse knowledge as to what actions need to be taken to reduce student fear of school violence. Examination of school characteristics associated with student fear in six countries. Researcher showed that indicators of school disorganization predicted greater fear of violence among students in the USA, Chile, Israel, The Netherlands, and Taiwan. Disorderly classroom and school environments predicted a higher level of student fear of becoming victims of school violence in these countries.

2.2.5 Student Behavior

Student misbehavior occurs at the beginning of the lesson, at the end of lesson, during downtime and during transition (Muijs; Reynolds, 2003). To avoid or minimize students' misbehavior, teacher set the rules at the beginning of the semester. Students should be help to set rules and they obey the rules. The reasons of why the classroom environment needs rules should be explained to students.

Mullis et al. (2004) examined the Lithuanian students' safety condition by TIMSS. Safety in schools (have you been hurt by other students, have you been left out of activities, etc) which considered high if the students answered "no" to five questions, an important correlate of TIMSS results. The Lithuanian students assessed the safety in schools higher than the international average (0.73δ) and this was reason for high TIMSS results in Lithuania.

2.2.6 Resources and Technology

Resources of a school are a part of materials available to school which allow it to capacity to provide instruction. Lee and Smith (1995) examined school restructuring effect on achievement by using National Education Longitudinal Study (NELS). They found positive effects on achievement of school restructuring using the National Education Longitudinal Study (NELS).

Greenwald, Hedges, Laine (1996) examined 60 primary research studies combined data at the level of school districts or smaller units and either controlled for socio economic characteristics or were longitudinal design. Their analysis found that a broad range of resources were positively related to student outcomes, with effect sizes large enough to suggest that moderate increases in spending may be associated with significant increase in achievement.

Fuchs and Wößmann (2007) stated that relations of student performance with schools' resource grants and teacher characteristics was that resources seem to be positively related to student performance, once family-background and institutional effects were extensively controlled for. This holds particularly in terms of the quality of instructional material and of the teaching force.

A systematic analysis of TIMSS 1999 indicated that teacher education, the frequency of assigning homework, and school autonomy improve the students' achievement. Dandy and Nettelbeck (2002) found the students' homework important as well. Textbooks determine the results of learning as much as teachers' qualification (Gopinathan, 1989, cited in the Mikk, 2006)
Textbooks, teacher quality and time were identified as being key factors emerging from school instructional effectiveness research (Creemers, 1996; Riddell, 1997 as cited in Howie, 2003)

Size of classroom affects the students' achievement. Reducing classroom size increased the students' achievement since teachers' deals with fewer students. Teachers can spend more time to individual students so the class size promotes academic achievement. Betts & Shkolnik (2000) studied the low achieving students in the small sized classroom. They benefited more since teachers spend more time with individual students. They made research with grade 7 and they indicated that teachers did not use extra time for the new material.

Stasz and Stecher (2000) researched that teachers in reduced and non-reduced classes (with maximums of 20 and 33 students, respectively) covered the same general topics in mathematics and language arts and did so for similar amounts of time. Some differences appeared in teaching practices; particularly teachers in small classes spent less time disciplining students and taught to the whole class less often. Also, students in small classes carried out more activities that are consistent with curriculum reforms in reading and mathematics, such as writing narrative pieces in language arts and playing mathematics games and using patterns to find relationships in mathematics.

Class size affects researched with the Tennessee' Project Star which was a longitudinal study between 1985 and 1989. Finn & Achilles (1999) was used the developed version of that project. Researchers stated that small class size increases student math performance in the primary years of the education by one third of a standard deviation while comparing students with their peers in regular classes with and without aids.

Bourke (1986) concluded from his study that the correlation between class size and achievement changed from insignificant to significant negatively when the student ability is directly controlled.

Greenwald, Hedges, Laine (1996) examined 60 primary research studies combined data at the level of school districts or smaller units and either controlled for socio economic characteristics or were longitudinal design in design. The class size have a minor effect on achievement.

Krueger's (1999) concluded that smaller class size has positive effect on students achievement estimated form Project Star in Tennessee. He estimated that a reduction in primary-school class size by one-third, from about 23 to about 15 students per class, led to an increase in student performance by about 22% of an SD in test scores.

Pong & Pallas (2001) examined the relationship between class size and eight grade mathematics achievement in US and abroad. Researchers concluded that class size tend to be greater and more homogenous in centralized education systems compared with those in decentralized systems. After controlling for possible confounding characteristics of the teacher, school, and classroom, in no other country than the US did they found a beneficial effect of small classes.

Students' behavior may provide a framework for affect of class size on student achievement. Betts & Shkolnik, (1999, Rice, (1999), Stasz & Stecher (2000) found that teachers spend less time for classroom order and management in smaller classes. Finn, Pannozzo, and Achilles (2003) stated that, students in small classes are more engaged in learning behavior and display less disruptive behavior compared to students in large classes.

Different results were also found at the end of research. Milesi and Gamaron (2006) found that there is no evidence of class-size effects on student achievement in either reading or mathematics. The results indicated that class size is equally insignificant for students from different race/ethnic, economic, and academic backgrounds. Nye, Hedges, and Konstantopoulos (2002) reported no additional advantage of class size for low-achieving students. Jürges and Schneider's (2004) research has revealed no relationship between the class size and the students' performance. Bigger classes are in bigger schools and the students of the bigger schools have a higher achievement indicator. Jürges and Schneider (2004) conclude that "it is hard to find any systematic effect of interesting variables such as resources, decentralized decision-making or central exit examinations on average student performance." O'Dwyer (2005) has also found "that the availability of school resources for mathematics was not a strong predictor of the differences in achievement between schools."

According to IEA's report, TIMSS participating countries with larger class sizes than international average class size have higher achievement levels than the international average. Significantly greater percentage of students in high achieving schools were in larger than average mathematics classes in Australia, Canada, Lithuania, Czech Republic, Korea, Belgium(Fr), Netherlands, Belgium(FI), Hong Kong.

Philips (1997) stated that academic press was both positively related to average mathematics achievement and most strongly related to the achievement of students who enter middle school with low scores.

2.3 Studies about the Student Related Factors

Socio-economic status (SES) of families has a positive relationship on the students' achievement. The correlation between SES and student academic achievement is around 0.3 at the individual level. When the school is the unit of analysis, then the correlation coefficient is around 0.7 (Yang, 2003 as cited in Mikk, 2006). Average socioeconomic status was significantly related to average mathematics achievement for high school students in previous studies (Lee & Bryk, 1989; Raudenbush & Bryk, 1986)

Lytton & Pyryt (1998) examined what factors beyond social class account for between-school variation in achievement by analyzing the school-by-school achievement test results in language arts and mathematics for Grades 3 and 6 in all elementary schools of the Calgary Board of Education. Social-class variables (average family income of the catchment area of each school and a social-adversity index) explained up to 45% of the variation in achievement tests. They showed that in Canada between 35% and 50% of the variation in elementary students' academic achievement can be attributed to SES.

Ramirez (2005) stated as socio economic status of students families as important factor in explaining academic achievement. Poorer students accomplish substantially lower achievement levels than their peers from more economically advantaged backgrounds.

2.3.1 Home Background

The effects of the student home background and the composition of the student body must be taken into account while studying the effects of school factors on achievement. Research studies showed the affect of student home background on achievement Coleman (1966), Jencks et.al (1972), Blakey and Heath (1992). Student home background covers socioeconomic factors with the parental emphasis on and support academic achievement.

O'Dwyer (2005) found that the home background index was an important predictor of academic achievement. The index included the educational level of mother and father and the books at home. Parents' education and the number of books at home were significant factors of TIMSS 2003 mathematics results in Lithuania. Jürges and Schneider (2004) have revealed the same factors and PC at home as the facilitators of school performance. The students who always spoke the test language at home scored 15 points higher than the students who never spoke the test language at home.

2.3.2 Number of Books in Home

Number of books is a good predictor of the student's mathematics achievement because of indication of educational environment. The greater the number of books in the home increased the mathematics achievement. Papanastasiou (2000) indicated that the size of home library is a good pointer of an educational environment which values literacy, the acquisition of knowledge and academic achievement.

The numbers of books at home were significant factors of TIMSS 2003 mathematics results in Lithuania (Elijio A., Dudaitė J., 2005 as cited in Mikk, 2006). Jürges and Schneider (2004) have revealed the same factors and PC at home as the facilitators of school performance.

2.3.3 Presence of Study Aids

Sukon and Jawahir (2005) stated the positive relationship between mathematic achievement and having aids at home. Chernichovsky (1985) examined the household demographic on children's schooling on Botswana. Researcher defined house hold wealth as assets which enhance children's productivity and dominates the wealth effect at low and intermediate level. The wealth effect appeared to dominate when households are relatively well endowed in house. Researcher also concluded that when substitutes for child labor are available in the household, children appear to be freed for schooling.

Sukon and Jawahir (2005) examined the home related factors which influence numeracy performance at primary level in Mauritius. They used the data from the survey which was carried out jointly by UNESCO and UNICEF with the collaboration of the Government of Education. The survey was carried with 1800 fourth-grade pupils who were taken from 60 primary schools. They concluded that level of education of parents, availability of reading materials at home, home possession, parental support in education and familiarity with English at home are the major causing variation in the children's numeracy achievement.

2.3.4 Level of Educational Attainment of Parents

The level of the parents is another factor affects the mathematics achievement. Researches stated educational background of the family correlates positively and clearly with the mathematics achievement. Research has shown that parents with higher educational levels frequently marked greater confidence in their ability to support their school-going children at academic and levels (Chinapah, 1983; Harmon et al., 1997 Harmon et al., 1997).

Chernichovsky (1985) examined the socioeconomic characteristics on children's schooling on Botswana. Postulating a positive wealth effect and negative price effect on schooling were supported by the data. Wealth effect was supported by the level of the education of the head of household. It is affecting the children's schooling. Educated parents send more children to school and keep them there longer than the uneducated parents.

Sukon and Jawahir (2005) concluded the importance of the parental support with related education level of parents on the achievement. Less educated parents cannot support their children enough. They can offer less opportunity to study. Educated parents maintain their children both academically and psychologically. They are aware of the books that they need to buy and help them in their homework. These type behaviors' motivates children to do well in their studies.

2.3.5 Calculators and Computer

Impact of the technology does not appear automatically, influence of calculators and computers depends on how teachers use that technology in class. Showing positive relationship studies and negative relationship studies exist.

Wenglinski (1998) used national study 1996 National Assessment of Educational Progress (NAEP) in mathematics, consisting of national samples of 6,227 fourth graders and 7,146 eighth graders. Data of frequency of computer use for mathematics in school, access to computers at home and in school, professional development of mathematics teachers in computer use, and the kinds of instructional uses of computers in the schools were used. They found a negative relationship between the frequency of use of school computers and school achievement. The study stated that the greatest inequities in computer use are not in how often they are used, but in the ways in which they are used.

Pelgrum and Plomp (2002) found similar result by using international data. Researchers used TIMSS 95 data since the data unique for combining indicators of student achievement in mathematics with indicators of use of computers in school subject. They found that students who used ICT frequently for mathematics learning had much lower mathematics scores than students who hardly used or did not use ICT.

Kozma (2003) examined the findings from 174 case studies of innovative pedagogical practices using technology from 28 participating countries looking at how classrooms worldwide are using technology to change the practices of teachers and students. The results of this study indicated that other classroom practices are more likely to be associated with certain teacher and student outcomes, at least as they are reported in our case studies. It seems that tool use and tutorials alone may not have as great an impact on student learning as technology-based research projects and technology used to manage information, at least according to self reports.

Wenglinski (1998) found certain uses of technology had a positive effect on achievement. In eighth grade, teachers' professional development in the use of technology and its use to teach higher order thinking skills were positively related to mathematics achievement.

2.3.6 Homework

Homework is complex process by involving different actors (teacher, students, parents), serving various purposes (e.g., achievement improvement, self regulation), involving tasks of different quality (e.g., routine vs. complex tasks), and impacting the organization of lessons (e.g., discussing, checking). The relationship between homework and student achievement is shown by researchers (Neuwahl & Van den Bogaart, 1984; Van der Sanden, 1989). De Jong; Westerhof; Creemers (2000) stated that many studies have been intended for relationship between homework and achievement in the USA as 'checking and grading' of homework seems to be related to achievement. The majority of these studies show positive relationships between homework (time) and achievement. On the other hand, there are indications that homework time is not consistently related to achievement across grade levels (Cooper, 1994) and across nations (Burstein, 1993).

Walberg (1984) stated that the effect sizes of key variables in education as homework which was compared to no homework had an effect size of .28. If homework is given frequently the effect size rises to .49. If teachers check and grade homework the effect size is highest (.80).

De Jong; Westerhof; Creemers (2000) analyzed whether any significant homework characteristics were related to mathematics achievement in Netherlands. Teachers hardly check the results of homework individually. Researchers could not answer the relation between achievement and checking homework because there was no variance in checking. Researchers found teachers in the Netherlands complain that this is impossible in a situation with large classes and a large workload of lessons each week. More frequent checking is negatively related to achievement (based on partial correlations), indicating that Dutch teachers check whether homework is done more frequently in classes with low ability and low achieving students.

Rodriguez (2004) studied was primarily cross-sectional, examining existing conditions of several student and classroom characteristics and their relationships to student achievement by using TIMSS data set. HLM analyses were conducted to see relations between student and teacher variables. Rodriguez found amount of time spent was not always clearly related to achievement.

Trautwein et al. (2002) collected data from 1,976 German seventh graders in 125 classes by repeated measurement. They examined the role of homework in enhancing mathematics achievement. Trautwein et al. (2002) controlled for prior achievement, intelligence, SES, motivation, and type of secondary school. They concluded monitoring of homework completion did not contribute significantly to mathematics achievement.

2.4 Related Studies with Research Content

Kiamanesh (2004) tried to identify the number of factors that represents relationships among sets of interrelated variables using TIMSS 99 Student Background Questionnaire data (35 items) for Iranian students. Researcher tried to examine the contribution of each factor on explaining the variance of students' mathematics achievement and the total variance that could be explained by the determined factors. The related data were factored utilizing principal component factor analysis using Varimax rotation. Based on the Scree test and Eigenvalues over one, eight factors were retained. Mathematics self-concept, home background, teaching, and attitude explained 12.3, 5.1, 1.6 and 0.9 percent of the variance, respectively. The variance explained by press, attribution and motivation factors, even though significant, was negligible, school climate did not enter in the equation.

Ramirez (2005) studied Chilean students like and value mathematics by using data from the TIMSS 1999. Hierarchical linear models were used to predict mathematic achievement both at the student-within-class and class levels. At both levels, students' perceived difficulty of doing mathematics, expectations for further education, and beliefs regarding the causes of their mathematics outcomes were significant predictors of achievement. However, classes having more students liking mathematics had significantly lower mean scores. The result is interpreted as the consequence of the more demanding curriculum and tougher grading standards used in higher performing classes.

Akyüz (2006) investigated the effects of mathematics teacher characteristics on students' mathematics achievement across Turkey, European Union countries by analyzing the data collected from student and teacher background questionnaires and mathematics achievement test in TIMSS-R. After home educational resources of students were taken as a control variable, explanatory models were built by using HLM. Researcher was found that there were some differences in the factors affecting mathematics achievement significantly among the countries except mean of home educational resources which had positive significant effect on mathematics achievement in all the countries. In Turkish model, the classes of male teachers were more successful and teacher experience, time spent on tests and quizzes, use of textbooks, disciplined class climate and class mean of home educational resources were found to have positive significant effect on student achievement.

Ismail & Awang (2008) studied differences in mathematics achievement among eighth-grade students using TIMSS 99 of Malaysian students. A series of school, home, demographic and socio-economic variables were used to investigate the differences in the mean student mathematics scores. Results of the study showed that that gender, the language spoken at home, expected educational level, family background, and home educational resources and aids have a significant influence on the students' level of mathematics achievement.

Ismail & Awang (2008) examined the effects of students' characteristics and attitudes towards mathematics learning on their achievement of grade eight students using Malaysian data drawn from TIMSS 2003. Background information including gender of students, parents' education level and whether students speak the language of test at home were assessed in terms of their influence on mathematics achievement. The number of books in home, availability of study desks and computers in home were labeled as educational resources while students' attitude taken into account students' educational aspirations, their perception of being safe in school, time spent on mathematics homework, self-confidence in learning mathematics and the value students place on mathematics. Chi-squared tests and odds ratios were used to check the associations and strength of the relationships of these factors with mathematics achievement. Results explained that except for gender, language spoken at home and time spent on mathematics homework, all of the other variables have significant positive influence in classifying students to low, medium and high achievers.

Yayan & Berberoglu (2004) investigated a linear structural model to explain the relationships among a set of latent variables, constituted through the use of principal component 'analysis and confirmatory factor analysis. The sample of the study was 240 Turkish schools with 7841 students which were participated to TIMSS-R. Results of researchers study indicated that three factors, home family background characteristics, what teachers do in the classroom, and students' affective measures are very crucial variables to explain achievement in mathematics.

Alacacı & Erbaş (2009) investigated the effects of certain school characteristics on students' mathematics performances in Turkey in the PISA 2006 Researchers controlled family background and demographic characteristics. Three models of Hierarchical Linear Modeling (HLM) were constructed. Their results exposed that

55% of the variance is attributable to between-schools and the remaining 45% to individual student characteristics. About two-thirds of the 55% is explained by selectivity in admissions, time to study mathematics and students' SES, gender and the geographical region.

CHAPTER 3

METHODOLOGY

This chapter is devoted to methodology of the present study. This chapter contains population and sample, instruments, validity and reliability, procedure, data collection, data analyses and hierarchical linear modeling.

3.1 Population and Sample

TIMSS 2007 assessed students' mathematics and science achievement over 60 countries at the eight and fourth grade. In each country, nationally representative samples of approximately 3,500 eighth-grade students (ages 13 and 14 years old) students were assessed in about approximately 150 schools.

TIMSS used a school frame to correspond to define target population. The frame for coverage was stated at the Technical Report 2007 as 100%. Some of exclusions were made from that population so the frame of exclusions as school-level exclusions consisted of very small schools (MOS<10), special education schools, and schools that were difficult to reach (travelling difficulties) and within-sample exclusions consisted of functionally or intellectually disabled students.

TIMSS 2007 used a two-stage sampling procedure to ensure a nationally representative sample of students. In the first stage, schools were randomly selected, explicit stratification by region, for a total of seven explicit strata and in the second stage; Implicit stratification by school type (public, private), for a total of 14 implicit strata, one classroom was randomly selected within schools. Small schools sampled with equal probabilities. In each participating country;

approximately 150 schools were randomly selected for the assessment. In each school, one or two mathematics classrooms of eighth-grade students were randomly selected for a total of about 3,500 eighth-grade students in each country.

3.1.2 Subjects of the Present Study

As the Turkey sample, all the Turkish students assessed in TIMSS 2007 project were included in the present study. 4 498 students who were participated and 146 principals who answered the school questionnaire, teacher questionnaire, student questionnaire and mathematics achievement test in TIMSS 2007 project were included as the Turkey sample. The distribution of the schools and the students' geographical regions is given in Table 3.1.

Table 3.1 Turkey's School Sample According to Regions in TIMSS 2007.

Explicit Stratum	**Total Sampled Schools**	**Ineligible Schools**	**Participating Schools**			**Non-Participating Schools**
			Sampled	**1st Replacement**	**2nd Replacement**	
Marmara Region	40	1	39	0	0	0
Central Anatolian Region	26	0	26	0	0	0
Aegean Region	18	0	18	0	0	0
Mediterranean Region	18	0	18	0	0	0
Black Sea Region	16	0	16	0	0	0
Eastern Anatolian Region	14	2	12	0	0	0
Southeastern Anatolian Region	18	1	17	0	0	0
Total	**150**	**4**	**146**	**0**	**0**	**0**

3.2 Research Questions

The main research questions of the study were:

1. Which school factors have significant effect on the mathematics achievement of the students across Turkey by using TIMSS 2007 data?
2. What proportion of variance in mathematics achievement is explained by school related factors?

Research questions of the study were:

1. Are there differences in the students' mathematics achievement among schools?
2. Which school characteristics are associated with the differences in students' mathematics achievement in Turkey?
3. Which student characteristics are associated with the differences in students' mathematics achievement in Turkey?
4. Which school characteristics influence and student characteristics effect the students' mathematical achievement in Turkey?

3.3 Hypotheses

Based on the research question, following null hypotheses were constructed:

1. The variability among school means mathematic achievement is zero.
   $H_{0:}$ Var (B_0) = T=0, alpha=0.001
2. The effect of each of the selected school-level variables on achievement is zero.
   H_0: $\gamma_{1j}= \gamma_{2j}= \gamma_{3j}=\ldots\ldots= \gamma_{16j}=0$, alpha=0.001
3. The effect of each of the selected student-level variables on achievement is zero.
   H_0: $\beta_{1j}= \beta_{2j}= \beta_{3j}=\ldots\ldots= \beta_{12j}=0$, alpha=0.001

3.4 Instruments

3.4.1 Mathematics Achievement Test

Mathematics achievement defined as (TIMSS 2007, International Mathematics Report): mathematics achievement was organized around two dimensions, a content dimension specifying the subject matter domains to be assessed within mathematics and a cognitive dimension specifying the thinking processes or domain to be assessed.

The content domains are number, algebra, geometry, and data and chance. Mathematics framework describes each content domain in terms of specific topic areas covered and the objectives within each topic.

The cognitive domains are the same for both grades- knowing, applying, and reasoning. Each cognitive domain is described according to the sets of processing behaviors expected of students as they engage with the mathematics content. The emphasis across the cognitive domains is such that the majority of the items assess the applying or reasoning domains (TIMSS 2007, International Mathematics Report, pg,26) 215 items totaling 238 score points approximately half the items are constructed-response and half are multiple-choice.

Table 3.2 Target percentages of the TIMSS 2007 Mathematics Assessment

Devoted to Content and Cognitive Domains at Eight

Eighth-Grade Content Domains	*Percentages*
Number	30%
Algebra	30%
Geometry	20%
Data and Chance	20%
Eighth Grade *Cognitive Domains*	*Percentages*
Knowing	35%
Applying	40%
Reasoning	25%

3.4.2 Student Questionnaire

Background questionnaires completed by students provide essential information. Home background and attitudes of students as learners in mathematics examined. The number of books in the home, availability of a study desk, the presence of a computer, the educational level of the parents, and the extent to which students speak the language of instruction have been shown to be important home background variables, indicative of the family's socio-economic status, that are related to academic achievement. Such factors are also indicative of the home support for learning and can influence students' overall educational aspirations. The extent to which employment, sports and recreational pastimes, and other activities occupy the student's time may also affect learning. Creating a positive attitude in students toward mathematics and science is an important goal of the curriculum in many countries. Students' motivation to learn can be affected by whether they find the subject enjoyable, place value on the subject, and think it is important in the present and for future career aspirations. In addition, students' motivation can be affected by their self confidence in teach the subject (TIMSS 2007, Assessment Frameworks).

In the present study, student characteristic variables such as highest level of education of either parent, students speak the language of test at home, students parents born in country, books in home, computer and internet connection, computer use, index of time students spend doing mathematics homework in a normal school week, index of students positive affect toward mathematics, index of students valuing mathematics, index of students' self confidence in learning mathematics were used. The student questionnaire can be seen at Appendix B.

3.4.3 School Questionnaire

School questionnaires completed by school principals provide essential information. The school factors that were examined in TIMSS were selected on the basis of eighth strands of research: school characteristics’, role of principal, parental involvement, school climate for learning, eighth grade instruction in mathematics and science, teachers in school, student behavior, resources and technology.

In the present study, school characteristic variables such as: principals reports on the percentages of students in their schools coming from economically disadvantaged homes, principals report on the percentage of students having the language of test as their native language, index of good attendance, principals time spent on various school related activities, schools encouragement of parental involvement, index of school resources for mathematics instruction, index of teachers’ adequate working conditions, school’s report on teachers mathematics professional development in past 2 years, index of principals perception of school climate. The school questionnaire can be seen at Appendix C.

3.4.4 Compounding Background Indices

TIMSS indices were intended to describe factors fostering mathematics achievement. Index were defined as a composite variable that assigns students to one of three levels (high, medium, low) on the basic responses to a series of component variables. The high category of index was expected to be most characteristic of a supportive learning environment. Low category of index was characterized the least learning environment. TIMSS used two different methods to create composite scales. The combined response method was used directly classify cases into high, medium, low depending on the combination of responses to source questions. Scale method was used when the construct of interest had an underlying quantitative continuum. The index score were computed by averaging the numerical values associated with each response option. Students were assigned to the three levels based on cutoff points. Component variables of the underlying scale were inter-correlated so that they formed a reliable scale and also that they were correlated to some extent with students' mathematics achievement. (Olsan et. all, 2008)

The reliability of underlying scales was assessed using Cronbach's alpha and the relationship with achievement was summarized by multiple correlation between component variables of the scales underlying indices and achievement (multiple R)and the percent of the variance in achievement accounted for by the component variables (R-square).Confirmatory factor analysis was used to examine the dimensionality of the scales underlying the indices and to present a latent trait measurement model of each scale and its component variables. (Olsan et. all, 2008)

3.4.4.1 Student Level Indices

Students were asked about their home environments and school experiences, and their attitudes toward mathematics. At eighth grade, three indices were representing students' attitudes toward mathematics: positive effect (PATM), self confidence (SCM), valuing the subject (SVM), and more index of time students spend on homework in mathematics (THM), and index of students' perceptions of being safe in school (SPBSS). Reliability and validity indicators for the attitudinal indices were given at the below Table 3.2.

Table 3.3 Reliability and Validity of Indices

INDICES		Grade 8		
		Cronbach's Alpha Between Component Variables	Multiple R between Student Achievement and Component Variables	Percent of Variance in Student Achievement Accounted for by the Component Variables
PATM	Turkey	0.76	0.31	0.10
	International Median	0.81	0.28	0.08
SCM	Turkey	0.76	0.5	0.25
	International Median	0.73	0.46	0.21
SVM	Turkey	0.60	0.19	0.04
	International Median	0.70	0.19	0.04
THM	Turkey	0.09	0.17	0.03
	International Median	0.10	0.11	0.01
SPBSS	Turkey	0.58	0.16	0.02
	International Median	0.62	0.16	0.03

The Index of Time Students Spend on Doing Mathematics Homework (THM), students were categorized according to their responses to two questions on the frequency of homework they were given and the amount of time they spend on that homework. A high level indicates homework in mathematics assigned at least 3-4 times a week and students spend more than 30 minutes on that homework. Low level indices indicated homework in mathematics no more than twice a week, and students spend no more than 30 minutes on that homework.

3.4.4.2 School Level Indices

School principals were asked to provide information about the school context and the resources available for mathematics instruction. Three indices were presented in TIMSS 2007 as the Index of Good Attendance at School (GAS), The Index of Availability of School Resources for Mathematics Instruction (ASRMI), The

Index of Principals' Perception of School Climate (PPSC). The Index of Good Attendance at School categorizes students according to their school principals' reports on the frequency of students' absenteeism and its severity as a disruptive influence on continuity in classroom and time for learning. Reliability and validity indicators for the attitudinal indices were given at the below Table 3.4.

Table 3.4 Reliability and Validity of Indices

INDICES		Grade 8		
		Cronbach's Alpha Between Component Variables	Multiple R between Student Achievement and Component Variables	Percent of Variance in Student Achievement Accounted for by the Component Variables
GAS	Turkey	0.81	0.17	0.03
	International Median	0.81	0.17	0.03
ASRMI	Turkey	0.82	0.27	0.08
	International Median	0.84	0.18	0.03
PPSC	Turkey	0.84	0.42	0.18
	International Median	0.81	0.23	0.05

3.4 Validity and Reliability

3.4.1 Content-Related Evidence for Validity

TIMSS expended enormous energy to guarantee the reliability, validity, and comparability of the data through careful planning and documentation, cooperation among participating countries, standardized procedures, and rigorous attention to quality control throughout. The data were collected according to rigorous scientific standards detailed in manuals, and countries receive training every step of the way (TIMSS International Mathematics Report, 20008).

Validity of tests extended to which inferences drawn from the results can be supported by evidence. Validity involved unified agreement in conceptualizing and articulating the constructs of mathematics and science as they apply to eighth-grade students, and unified agreement that the items included in the assessments measure those articulations of mathematics (Olsan et. all, 2008).

TI MSS must have comparative validity. For comparative validity, the classical concerns of reliability and validity still apply, but the concepts were extended to encompass the idea that the data should be internationally comparable. That is, that inferences made about achievement differences between countries can be substantiated (Olsan et. all, 2008).

3.4.2 Validity of Background Indices

The composition of each index variable reported in the TI MSS 2007 international reports was briefly described and indicators of validity for the component variables of these indices were presented. The relationship with achievement was summarized by the multiple correlation between the component variables of the scales underlying the indices and achievement (multiple R), and the percent of variance in achievement accounted for by the component variables (R-square). These statistics provided a sense of how well the component variables are related to mathematics and science achievement, which is an aspect of the validity of the index. In addition, confirmatory factor analysis was used to examine the dimensionality of the scales underlying the indices and to present a latent trait measurement model of each scale (Olsan et. all, 2008).

3.4.3 Reliability

At the international level, the reliability of the TIMSS 2007 mathematics achievement is obtained as 0.88. The reliability of the mathematics scale is 0.91. The reliability values for mathematics scale are quite high values representing high reliability (Olsan et. all, 2008).

3.5 Procedures

3.5.1 Design of the Study

In the present study, the factors will be investigated in order to get an insight about how the school level factors affect the student level factors and in turn how the student level factors influence the performance of 13-14 years-old students at 8^{th} grade on the mathematics achievement in TIMSS 2007. Therefore, hierarchical linear modeling will be selected as a modeling technique so as to investigate the relationships between all these variables. Therefore, this study is a quantitative research.

Furthermore, the design of the study could be stated as an associational research which is in fact a correlational study. As a result, the design of the present study can be mentioned as a quantitative research with non-experimental study.

3.5.2 Threats to Internal Validity of the Study

Fraenkel & Wallen (1996) mentioned subject characteristics, mortality, regression as treats to research. In the present study, the subjects of the study were chosen based on some characteristics such as being a 13-14 years-old students at 8^{th} grade. So, the subject characteristics could be a threat for study so it is common to drop some as the study progresses. The subjects of the study were selected by considering the loss of subjects during the study and more than needed students were selected in order to keep away from threat. Hence, the mortality could not be a threat for the present study. There was no intervention in the TIMSS 2007 project; this regression threat could not be a problem for the present study.

3.5.4 Ethical Issues in the Study

As known, ethical problems suggest three very important issues that every researcher should address. These issues are protecting participants from harm, ensuring confidentiality and the deception of the participants.

In the In TIMSS 2007 project, a script for introducing TIMSS to the students was provided in the Test Administrator's Manual. In addition, the instructions were read to the students for all of the testing sessions. Therefore, it could be said that the deception of the students was not an issue in the present study.

Furthermore, the schools were labeled with numbers and also the students were assigned numbers for the whole assessment, in order to set the confidentiality of the schools' and students' identities. Thus, the confidentiality was also ensured for the present study.

Lastly, since the students were assessed in their actual locations which were their own schools and classes, the harm for the students was also not an issue, consequently, the protection of participants from harm was also ensured by conducting the study in the actual locations.

3.6 Data Collection

Necessary data files used in the present study were downloaded from the TIMSS International Database included in the TIMSS Web Site, ***timss**.bc.edu/**timss2007**/frameworks.html.* All the information about the structure of the data files was obtained from the codebook files contained in TIMSS Web Site.

All the variables in the TIMSS 2007 Student Background Questionnaire, TIMSS 2007 School Background Questionnaire data files are examined. The variables of the interest are selected from these data files. All of the variables are investigated on the basis of descriptive statistical procedures. The descriptive data analyses are conducted to see response pattern, to understand the results of the analyses, to make appropriate conclusions about the results we get from the analyses and to discuss the analyses. All these interpretations could lead to conclude, discuss and interpret the reasons of study.

There is no need for conducting some of the inferential data analyses such as explanatory and confirmatory factor analyses since the variables are taken form TIMSS 2007. Factors are investigated to get an insight about the school level factors affect the student level factors and how the student level factors influence the students mathematics achievement in TIMSS 2007, Hierarchical linear modeling (HLM) is selected as a modeling technique. Hierarchical linear modeling (HLM) is preferred as a modeling technique instead of structural modeling technique since HLM has a nested structure. All of the relations between student level factors, school related factors and mathematics achievement could be explored by HLM 5.05. Therefore, hierarchical linear modeling for Turkey is performed using HLM 5.05 to examine relations between student, school related factors, and mathematics achievement in the present study.

3.8 Handling Missing Data

There should not be any missing data codes or blanks in the level-2 files. The missing data analyses were conducted for the level 2 data files for Turkey to estimate the amounts of the missing data in the level 2 variables. The criterion of the missing value percentage is 10%, in general for mean replacement.

The missing values for the school level factors ranging from 0 to 9.6%. There were exception only in one school variable computer access to internet had missing value percentage as 11.6. Although percentage of the missing value in that variable was exceeded the criterion mean replacement was conducted for the missing values of the school level factors.

The missing values for the teacher level factors ranging from 0 to 9.6%. There was exception only in one teacher variable prepared data judging chances had missing value percentage as 11.6. Although percentage of the missing value in that variable was exceeded the criterion mean replacement was conducted for the missing values of the school level factors

3. 9 Hierarchical Linear Modeling (HLM)

3.9.1 Conceptual Background for Two-Level Hierarchical Linear Models

Behavioral and social data commonly have a nested structure. For example, if repeated observations are collected on a set of individuals and the measurement occasions are not identical for all persons, the multiple observations are properly conceived as nested within persons. Each person might also be nested within some organizational unit such as a school or workplace. Within the hierarchical linear model, each of the levels in the data structure (e.g., repeated observations within persons, persons within communities) is formally represented by its own sub-model. Each sub-model represents the structural relations occurring at that level and the residual variability at that level (Raudenbush, Bryk, Cheong, & Congdon, 2001, p.1). HLM sub-models express relationships among variables within a given level, and specify how variables at one level influence relations occurring at another. Although any number of levels can be represented, all the essential statistical features are found in the basic two-level model (Raudenbush, & Bryk, 2002, p. 7).

3. 9.2 Hierarchical Linear Model Variables of the Present Study

3.9.2.1 Student Level Factors (Level-1 Variables)

Twelve student level factors were included as the level-1 variables in the hierarchical linear models of Turkey. All the student level factors were selected as the TIMSS 2007 indices calculated.

All twelve student level factors were as the following:

- Students speak the language of test at home
- Books in home
- Computer at home
- Internet connection

- Highest level of education of either parent
- Students' parents born in country
- Computer use
- Time students spend doing mathematics homework in a normal school week
- Students positive affect toward mathematics
- Students valuing mathematics
- Students self confidence in learning mathematics
- Students' perception of being safe in school

3.9.2.2 School Level Factors (Level-2 Variables)

Sixteen school level factors were included as the level-2 variables in the hierarchical linear models of Turkey. All the school level factors were selected from the TIMSS 2007 school questionnaire.

All sixteen school level factors were as the following:

- Principals report on the percentages of students in their schools coming from economically disadvantaged homes
- Principals report on the percentages of students in their schools coming from economically affluence
- Principals' administrative duties
- Principals' activity percentages of instructional leadership
- Principals' activity percentages of supervise teachers
- Principals' activity percentages of teaching
- Principals' activity percentages of public relations activity percentages of other
- Parents to attend special events
- Parents to raise funds for school
- Parents to volunteer for school programs
- Parents to ensure complete homework
- Parents to serve on school committee

- Good attendance
- School resources for mathematics instruction
- Principals' perception of school climate

3.9.2.3 Controlling Variable

It is critical to control for some student factors before attempting to assess the impact of various variables related to school in order to explore the school effect. In the present study, students SES, attitudes and resources was used as a control variable. The choice of the control variable depends on two reasons. Firstly, index variables were used. Secondly, the correlation analyses revealed that there was strong relationship between these student variables and Mathematical Achievement for the data of Turkey. Indeed, the student level variable having the strongest relation with mathematical achievement performance of the students was the mathematics self-efficacy levels of the students in Turkey.

3.9.2.4. Centering the Covariates

Covariates at the student level centered at the grand mean for that variable, all the mean over all students in the population. This is consistent with standard practice in the analysis of covariance and has implications for the interpretation of the regression coefficients in model. This means that, for each school, the intercept of the level 1 model is adjusted for the linear regression of the test scores on that variable, as putting all school means on an equal footing with respect to that variable. In HLM, the adjusted intercepts can be described as "adjusted school means". The variation among adjusted means will almost always be less, and usually less, than the variation among the adjusted means (Raudenbush and Bryk, 2002)

3.9.2.5. Centering predictors in Multilevel Analyses

Centering defines how Level-1 predictors are scaled. Two scaling options are grand mean centering, and group mean centering. Centering has both computational and substantive value. Centering increases computational ease and improves estimation by reducing colinearity of variables and product terms. Centering clarifies interpretation of results (Bryk & Raudenbush, 1992). Grand-mean centering was used to center the Level-1 variables in the ANCOVA model only. In grand-mean centering, the level-1 predictors take the form, X_{ij}-X. Grand mean centering yields an intercept that can be interpreted as the adjusted mean for school j adjusted differences in student level characteristics. Centering the predictors on their grand means, the regression coefficients represent the covariate effect of the Level-1 variables.

Group mean centering for the Level-1 predictors was selected for the random regression coefficients models and the intercept-slopes-as-outcomes models. Level-1 predictors take the form $X_{ij} - \cancel{X}_j$. The intercept, β_{0j} can be interpreted as the uncontrolled average achievement in each school. The intercept is the average level of achievement when other predictors are at their mean values. The intercept can be interpreted as the average level of achievement before the influence of the other Level-1 predictors is taken into account. The regression coefficients, β_{kj}, can be interpreted as the uncontrolled average relationships between Level-1 variables and achievement. For level-1 variables, the centered values were positive above the mean and negative below the mean. A positive regression coefficient suggests a larger differentiating effect from that variable on achievement, while a negative coefficient suggests a smaller differentiating effect.

In addition, the choice of group-mean centering simplifies the interpretation of contextual effects. The contextual effects occur when the aggregate of an individual characteristic is related to outcome even after controlling for the individual characteristic (Burstein, 1980). In group-mean centering the relationship between X_{ij} and Y_{ij} is directly decomposed into its within and between school components. Therefore the compositional effects of aggregate variables can be obtained directly from subtraction of appropriate regression coefficients.

3.9.2.6 Outcome Variable (Mathematical Achievement Plausible Values)

In TIMSS 2007 project, not all of the students responded to all of the mathematics items. Therefore, student proficiencies or measures were not observed for all the mathematics items. Since there were missing data that could be inferred from the observed item responses, several possible alternative approaches could be applied for making this inference. TIMSS used two approaches such as maximum likelihood using Warm's (1985) Weighted Likelihood Estimator (WLE) and maximum likelihood using plausible values (PV). Plausible values are a selection of likely proficiencies for students that attained each score. The plausible values are not text scores and should not be treated as such. They are random numbers drawn from the distribution of scores that could be reasonably assigned to each individual (OECD Publications, 2002b). Therefore, five overall mathematical literacy plausible values from PV1MATH to PV2MATH were computed for all of the participating students in the TIMSS 2007.

Actually, four models were built in order to investigate the effects of school level factors on students' mathematical achievement in the HLM analyses for Turkey. Similar with Turkey HLM analyses in the present study, five overall mathematics achievement plausible values from PV1MATH to PV5MATH were considered as mathematical achievement variables. Student level variables were weighted according to total weight of student variables.

All the four HLM models were conducted for the five mathematical achievement plausible values separately, and then the averages of the obtained values from the results of the HLM analyses were calculated. For instance, the first HLM model for Turkey were conducted five times in the consideration of the five mathematical achievement plausible values and the average values of the obtained results from the five analyses of the first HLM model were calculated and presented as the results of the first HLM model for Turkey. This process was conducted separately for the four HLM models for Turkey. Correspondingly, the process of calculating the average values of the results of the five plausible values for each model was carried among Turkey. Thus, all the five mathematical achievement plausible values were included as the outcome variables in the hierarchical linear models of Turkey.

CHAPTER 4

RESULTS

This chapter of thesis is devoted to the presentation of the results. Results were given in two parts as descriptive statistics and results of Hierarchical Linear Modeling (HLM). The results of HLM models were given for mathematics achievement, school variables and student variables. In descriptive statistics part, frequencies and descriptive measures were given. In HLM analysis part, hierarchical linear modeling assumptions and hierarchical linear models for selected school and student factors on mathematics achievement were made for Turkey.

4.1 Descriptive Statistics

Descriptive statistics were used to monitor the general pattern of responses to questions. Whole variables were included in the study were examined with respect to appropriate descriptive statistics such as their frequency distributions of the variables and descriptive measures. Form the analysis, most selected alternatives, the least selected alternatives, and the percentages of the responses given to alternatives were described at the descriptive statistics.

There were 146 school principal's data for school level and 4498 student data for student mathematics achievement. The selected student variables which were included in the study were as: students speak the language of test at home, books in home, computer at home, internet connection, highest level of education of either parent, students' parents born in country, computer use, time students spend doing mathematics homework in a normal school week, students positive affect toward mathematics, students valuing mathematics, students self confidence in learning mathematics, students' perception of being safe in school.

The selected school variables which were included in the study were as: principals report on the percentages of students in their schools coming from economically disadvantaged homes, principals report on the percentages of students in their schools coming from economically affluence, principals' administrative duties, principals' activity percentages of instructional leadership, principals' activity percentages of supervise teachers, principals' activity percentages of teaching, principals' activity percentages of public relations activity percentages of other, parents to attend special event, parents to raise funds for school, parents to volunteer for school programs, parents to ensure complete homework, parents to serve on school committee, good attendance, school resources for mathematics instruction, principals' perception of school climate.

4.2 Hierarchical Linear Modeling (HLM) Analysis

The mathematic achievement of Turkish students was analyzed by using four different models. The analyses were made by using HLM 5.05 program. The models were given in four sections: one-way analyses of variance with random intercept model, means-as- outcome model, random coefficient model and an intercepts -and slopes- as outcomes model: the effects of school, teacher and students.

4.2.1 Results of Research Question I (One Way Analysis of Variance)

One-way ANOVA produces practical preliminary information about how much variation in the dependent variable lies within and between schools and about the reliability of each school's sample mean estimate of its true population mean.

The research question for the one way ANOVA model for Turkey supplied information about whether there are differences in the mathematics achievement among schools in Turkey.

The level-1 and level-2 models are the same as previously explained at the chapter 3.

The level-1 level: $Y_{ij} = \beta_{0j} + r_{ij}$

The level-2 model: $\beta_{0j} = \gamma_{00} + \upsilon_{0j}$

Y_{ij} = Mathematics Achievement

β_{0j}= Intercept

r_{ij} = Student level factor

γ_{00}=Grand Mean

υ_{0j}=Random effect associated with unit j (school)

The Final Estimation of Fixed Effects obtained from analysis of variance model of Turkey was given in Table 4.1. The results of one-way analyses of variance with random intercept model for Turkey were shown below. Analysis of variance indicated that there were significant differences among schools. The measurement of the variation among schools in their mean mathematics achievement scores can be calculated. Under the normality assumption 95% of the school mean falls within the range. The grand mean of mathematics achievement is 438.99 with a standard error 6.63 indicating a 95 % confidence interval of:

Confidence Interval = $438.99 \pm 1.96 * (6.63) = (425.99 \leq X \leq 451.98)$

Table 4.1 Final Estimation of Fixed Effects of Mathematics Achievement for All TIMSS 2007 Students (Analysis of Variance Model of Turkey)

Fixed Effect	*Coeff*	*S.E.*	*d.f.*	*T-Ratio*	*p-value*
Average school mean, γ_{00}	438.99	6.63	145	66.186	0.000

The final estimation of variance components obtained from analysis of variance model of Turkey was given in Table 4.2.

Table 4.2 Final Estimation of Variance Components (Analysis of variance Model of Turkey)

Random Effect	Standard Deviation	Variance	df	X^2	*p*-value
School Mean, υ_{0j}	77.97	6080.76	145	3450.80	0.000
Level 1 Effect, r_{ij}	85.58	7324.46			

At the student level sigma squared = 7324.46
At the school level Tau= 6080.76

The maximum likelihood estimate of the variance components is also given. The final estimations of variance components and the intra-class correlation coefficient for students as: at the student level σ^2= 7324.46 (within classes) and at the school level, γ_{00} is the variance of the true school means, β_{0j}, around the grand mean. The variance component for the school means is τ_{00}= 6080.76 (between classes). This shows a substantial proportion of variation among schools as estimated by the interclass correlation:

$$p_{ic} = \frac{\tau_{00}}{\tau_{00} + (\frac{\sigma^2}{n_j})} = \frac{6080.76}{(6080.76+7324.46\ )} = 0.4536$$

Hence, 45 % of the variance in mathematics achievement is among schools.
Proportion of student level or within school variance:

$$p_{ic} = \frac{\sigma^2}{\tau_{00} + \sigma^2} = \frac{7324.46}{(6080.76+7324.46\ )} = 0.5463$$

Hence, 54.63 % of the variance in mathematics achievement is within schools.

HLM offers an estimate of the reliability of the sample mean in any school. The reliability is an estimate of the true school mean and is impacted by the sample size within each school. The overall estimate of reliability is the average of school reliabilities $\rho = 0.95$ indicating that the sample means tend to be a reliable indicator of true school means. The equation for determining reliability of the mean mathematics achievement within each school is:

$$p = \frac{\tau_{00}}{\tau_{00} + (\frac{\sigma^2}{n_j})}$$

The reliability is affected by the within school size (n_j) of the sample.

As a result, test statistics displayed at Table 4.2 (X^2= 3450.80, df=145) shows significant variation (p< 0.001) variation among schools in mathematic achievement. Findings from one way ANOVA models showed that, the achievements of school were significantly different in their mathematics achievement. The result also implies that school level variables might account for the differences in the students' mathematics achievement.

4.2.2 Results of Research Question II (Means as Outcomes Model)

The second research question of HLM analyses for Turkey offered information about which school characteristics are associated with the differences in the students' mathematics achievement in Turkey. In HLM, this research question is termed as Means as Outcomes Model. In means-as- outcome model, level 1 model equation remained unchanged. Students' mathematics achievement was observed as varying around their school means.

The equations to answer this question are:

The level-1 model: Mathematics achievement (Y_{ij}) = $\beta_{0j} + r_{ij}$

The level-2 model:

$\beta_{0j} = \gamma_{00} + \beta_{01}$*(GSB-1)+ γ_{02}*(GSB-2) + γ_{03}*(GAP-1) + γ_{04}*(GAP-2) + γ_{05}*(GAP-3) + γ_{06}*(GAP-4) + γ_{07}*(GAP-5) + γ_{08}*(GAP-6) + γ_{09}*(GAP-7) + γ_{010}*(GAP-8) + γ_{011}*(GAP-9) + γ_{012}*(GAP-10) + γ_{013}*(GAP-11) + γ_{014}*(GAS) + γ_{015}*(SRM) + γ_{016}*(PPSC) + υ_{0j}

For j= 1, 2, 3...n schools

Y_{ij} = Mathematics Achievement

γ_{0j}= The school mean on the mathematics achievement

r_{ij} = Student level factor

γ_{00}= The grand mean for mathematics achievement. The average of school means on mathematics score across population of schools

γ_{01} = The differentiating effect of principals report on the percentages of students in their schools coming from economically disadvantaged homes on school mean on mathematics achievement

γ_{02} = The differentiating effect of principals report on the percentages of students in their schools coming from economically affluence on school mean on mathematics achievement

γ_{03} =The differentiating effect of principals' administrative duties on school mean on mathematics achievement

γ_{04} = The differentiating effect of activity percentages of instructional leadership on school mean on mathematics achievement

γ_{05} = The differentiating effect of activity percentages of supervise teachers on school mean on mathematics achievement

γ_{06} = The differentiating effect of activity percentages of teaching on school mean on mathematics achievement

γ_{07} = The differentiating effect of activity percentages of public relations on school mean on mathematics achievement

γ_{08} = The differentiating effect of activity percentages of other on school mean on mathematics achievement

γ_{09} = The differentiating effect of ask parents to attend special events on school mean on mathematics achievement

γ_{10} = The differentiating effect of ask parents to raise funds for school on school mean on mathematics achievement

γ_{11} = The differentiating effect of ask parents to volunteer for school programs on school mean on mathematics achievement

γ_{12} = The differentiating effect of ask parents to ensure complete homework on school mean on mathematics achievement

γ_{13} = The differentiating effect of ask parents to serve on school committee on school mean on mathematics achievement

γ_{14} = The differentiating effect of good attendance on school mean on mathematics achievement

γ_{15} = The differentiating effect of school resources for mathematics instruction on school mean on mathematics achievement

γ_{16} = The differentiating effect of on school mean on mathematics achievement principals' perception of school climate on school mean on mathematics achievement

υ_{0j}=Random effect associated with unit j (school)

The means as outcome model was constructed for all Turkey TIMSS 2007 sample. The model was first run with all 16 factors, but 3 factors (GAS, GSB-2, GAP-8) were not significant were removed from the analysis. The remaining 13 (GSB-1, GAP-1, GAP-2, GAP-3, GAP-4, GAP-5, GAP-6,GAP-7, GAP-9,GAP-10, GAP-11, SRM, PPSC) factors were run but 6 of these factors (GAP-1,GAP-5, GAP-6, GAP-7, GAP-9,GAP-10,) were not significant so they were removed from the analysis. The remaining 7 (GSB-1, GAP-2, GAP-3, GAP-4, GAP-11, SRM, PPSC) factors were run but 4 of these factors (GAP-2, GAP-3, GAP-4, GAP-11) were not significant so they were removed from the final analysis. The remaining 3 factors (GSB-1, SRM, and PPSC) and GAP-8 were run analysis. The reason of adding GAP-8 was that, all factors were run one by one and these 4 factors were significant with mathematics achievement so GAP-8 added again to the analysis. The final estimation of fixed effects obtained from means as outcomes model of Turkey was given in Table 4.3.All of these 4 factors will be reexamined during the development of the final full Intercepts and Slopes as Outcomes Model (Research Question 4).

Table 4.3 Final estimation of Fixed Effects (Means as Outcomes Model of Turkey)

Fixed Effect	Coeff.	S.E.	T-ratio	d.f.	*p*-value
Model for School Means[1]					
INTRCPT2, γ_{00}	439.14	4.82	91.08	141	0.000
GSB-1, γ_{01}	-36.07	6.61	-5.456	141	0.000
GAP-9, γ_{02}	-20.15	10.68	-1.88	141	0.059
SRM, γ_{03}	-18.00	8.13	-2.21	141	0.027
PPSC, γ_{04}	-28.21	10.05	-2.80	141	0.005

[1]The school level variables were Grand Mean Centered before analysis.

The results obtained from Table 4.3 indicate a significant association between of principals report on the percentages of students in their schools coming from economically disadvantaged homes and mathematics achievement (γ_{01}=-36.07, se= 4.32); parents to volunteer for school programs and mathematics achievement (γ_{02}= -20.15, se= 6.61); school resources for mathematics instruction on mathematics achievement (γ_{03}=-18.00, se=8.13); principals' perception of school climate on mathematics achievement (γ_{04}=-28.21, se=10.05). Intercept values showed that how much each variable affected mathematics achievement.

The final estimation of variance components obtained from means as outcomes model of Turkey was given in the Table 4.4. The degrees of freedom for this model is based on the number of schools with sufficient data, number of school level variables included in this model.

Degrees of Freedom= J-Q-1

J: the number of schools with sufficient data

Q: number of school level variables included in the model.

Thus, all schools were used in this analysis and degrees of freedom for this model is df = J-Q-1 = 146- 4 -1=141

Table 4.4 Final Estimation of Variance Components

Random Effect	Standard Deviation	Variance	df	X^2	P-value
School Mean, υ_{0j}	55.90	3125.42	141	1846.68	0.0000
Level-1 Effect, r_{ij}	85.58	7324.76			

The residual difference between schools (τ_{00}=3125.42) is substantially smaller than the original variance (τ_{00}=7324.76) resulting from the analysis of variance model. This reduction is due to inclusion of school related factors. By comparing the τ_{00} estimates across the two school means (analysis of variance model and means as outcomes model) an index of proportion reduction can be developed, or simply, the variance accounted for the school level factors can be examined.

$$\text{Proportion of variance explained in } \beta_{0j} = \frac{\tau_{00}}{\tau_{00}+\sigma^2}$$

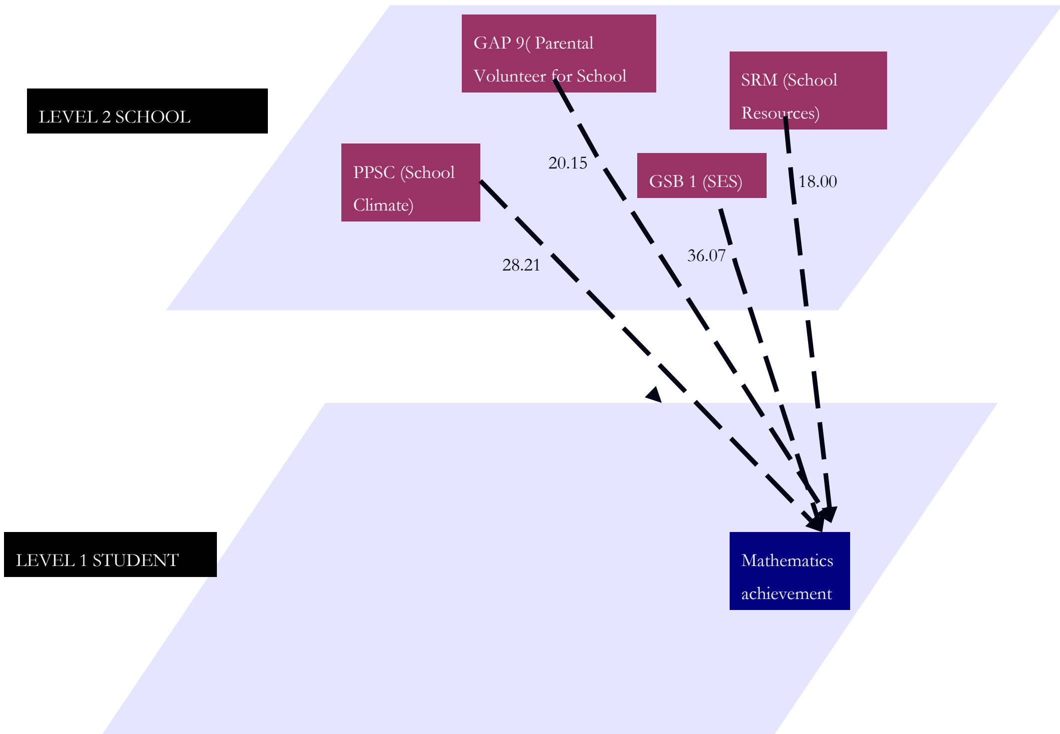
$$\text{Proportion of variance explained in } \beta_{0j} = \frac{7324.76-3125.42}{7324.76} = 0.5733$$

This indicates that 57.33% of the true between school variance in mathematics achievement is accounted for by (GSB-1, GAP-9, SRM, and PPSC). Finally, the X^2 statistics is found as 1846.68 (df =141, p<0.001) in the analysis indicating that these four school level variables account for all the variation in the intercepts.

Mathematics achievement score of the Turkish students were predicted by the school variables of GSB-1, GAP-9, SRM, and PPSC in the means-as-outcome model. The proportion of variance explained by means-as-outcome model of Turkish students' mathematics achievement was 57.33%.

Figure 1 illustrates the model results

Figure 1 Model 2



4.2.3 Results of Research Question III (Random Coefficient Model)

The fourth research question of HLM analyses for Turkey provided information about which student characteristics that explain the differences in the students' mathematics achievement in Turkey. In HLM, this research question is termed as random coefficient model.

The equations to answer this question are:

Level-1 Model

Mathematics Achievement = $\beta 0$ + β_1*(GOL) + β_2*(GBO) + β_3*(GTH-2) + β_4*(GTH-5) + β_5*(GED) + β_6*(GBO) + β_7*(GCA) + β_8*(MTM) + β_9*(MPA) + β_{10}*(MSV) + β_{11}*(MSC) + β_{12}*(GPB) + r_{ij}

The variance of r_{ij}, σ^2, represents the residual variance at level-1 that remains unexplained after taking into account students' level predictors.

The school level models are:

$\beta_0 = \gamma_{00} + \upsilon_0$

$\beta_1 = \gamma_{10} + \upsilon_1$

$\beta_2 = \gamma_{20} + \upsilon_2$

$\beta_3 = \gamma_{30} + \upsilon_3$

$\beta_4 = \gamma_{40} + \upsilon_4$

$\beta_5 = \gamma_{50} + \upsilon_5$

$\beta_6 = \gamma_{60} + \upsilon_6$

$\beta_7 = \gamma_{70} + \upsilon_7$

$\beta_8 = \gamma_{80} + \upsilon_8$

$\beta_9 = \gamma_{90} + \upsilon_9$

$\beta_{10} = \gamma_{100} + \upsilon_{10}$

$\beta_{11} = \gamma_{110} + \upsilon_{11}$

$\beta_{12} = \gamma_{120} + \upsilon_{12}$

where;

β_{0j}= the mean of mathematics achievement

β_{1j}=the differentiating effect of students speak the language of test at home
β_{2j}=the differentiating effect of books in home
β_{3j}= the differentiating effect of computer at home
β_{4j}= the differentiating effect of internet connection
β_{5j}= the differentiating effect of highest level of education of either parent
β_{6j}=the differentiating effect students' parents born in country
β_{7j}=the differentiating effect of computer use
β_{8j}=the differentiating effect of time students spend doing mathematics homework in a normal school week
β_{9j}=the differentiating effect of students positive affect toward mathematics
β_{10j}=the differentiating effect of students valuing mathematics
β_{11j}=the differentiating effect of students self confidence in learning mathematics
β_{12j}=the differentiating effect of students' perception of being safe in school

γ_{00} is the average of school mean on mathematics achievement across population of schools;
$\gamma_{010} - \gamma_{120}$ are the average predictors- mathematics achievement regression slope across these schools;
υ_0 is the unique increment to the intercept associated with school j;
$\upsilon_1 - \upsilon_{12}$ are the unique increment to the slope associated with school j.

Mathematics achievement was regressed on the student level predictors that were grand-mean centered. Random coefficient model with significant student level variable were constructed for mathematics achievement. The random coefficient regression models were constructed for all Turkish TIMSS 2007 sample.

The building strategy which was recommended by Bryk and Raudenbush (2002) was utilized. The student characteristics were first examined individually (GOL, GBO, GTH-2, GTH-5, GED, GBO, GCA, MTM, MPA, MSV, MSC, GPB) to determine whether they were significantly related to mathematics achievement and whether or not they were randomly varying. One of these variables individually (MTM) were found to be non-significant and non-randomly varying so they were removed from the model.11 of these variables (GOL, GBO, GTH-2, GTH-5, GED, GBO, GCA, MTM, MPA, MSV, MSC, GPB) were found to be significantly and randomly varying. These 11 variables were examined and 3 (GTH-2, GTH-5, MSV) of these were significantly related to mathematics achievement and the variables observed to be both significantly related mathematics achievement and randomly varying. The final estimation of fixed effects obtained from random coefficient model of Turkey was given in Table 4.7.

Table 4.5 Final Estimation of Fixed Effects (Random Coefficient Model of Turkey

Fixed Effect	*Coefficient*	*S.E.*	*T-ratio*	*p-value*	*Approx. d.f.*
Overall mean mathematics achievement[1], $У_{00}$	435.66	4.87	89.29	0.000	145
GOL, B_1	-17.19	2.95	-5.81	0.000	20
GBK, B_2	7.55	1.41	5.32	0.000	132
GED, B_3	-10.56	1.54	-6.81	0.000	145
GBO, B_4	-25.80	5.19	-4.96	0.000	18
GCA, B_5	-4.46	1.49	-2.97	0.003	62
MPA, B_6	-9.54	1.98	-4.81	0.000	145
MSC, B_7	-44.30	1.88	-23.44	0.000	145
GPB, B_8	-4.94	1.82	-2.71	0.007	145

[1]The student level variables were Grand Mean Centered before analysis.

The student who speak the language of test at home and mathematics achievement slope coefficient ($У_{10}$=-17.19, se=2.95) indicates that students who speak the language of test at home performed significantly differently on mathematics achievement. The student whose parents born in the country and mathematics achievement slope coefficient ($У_{20}$=7.55, se=1.41) indicates that students whose parents born in the country performed significantly differently on mathematics achievement. The student whose parents have highest level of education and mathematics achievement slope coefficient ($У_{30}$=-10.56, se=1.54) indicates that students whose parents have higher level of education performed significantly differently on mathematics achievement. The student who have books in home and mathematics achievement slope coefficient ($У_{40}$=-25.80, se=5.19) indicates that students who have books in home significantly differently on mathematics achievement. The student who use computer and mathematics achievement slope coefficient ($У_{50}$=-4.46, se=1.49) indicates that students who use computer performed significantly differently on mathematics achievement. Students positive affect toward mathematics and mathematics achievement slope coefficient ($У_{60}$=-9.54, se=1.98) indicates that students who have positive affect toward mathematics performed significantly differently on mathematics achievement. Students' self confidence in learning mathematics and mathematics achievement slope coefficient ($У_{70}$=-44.30, se= 1.88) indicates students who have self confidence in mathematics performed significantly differently on mathematics achievement. Students' perception being safe in school and mathematics achievement slope coefficient ($У_{80}$= -4.94, se= 1.82) indicates students who percept being safe in school performed significantly differently on mathematics achievement.

The final estimation of variance components obtained from random coefficient model of Turkey was displayed in the Table 4.8. The degrees of freedom to test for random effect for Random Coefficient Model are based on the number of schools that had sufficient data to compute a separate OLS regression. 6 schools did not have sufficient data; data sets did not give knowledge about these six schools. These lost of data affected a little our analysis result, but these affect can be neglect for our general picture of analysis. The intercept and coefficients form the fixed effect portion of the table are based on empirical bayes estimates which utilize all data.

Estimates of variance components for the random effects, and tests of the hypothesis that these variance components are null are also provided. All the factors are not varied significantly as can be seen from the table 4.8 (each has a p value > 0.005)

Table 4.6 Final Estimation of Variance Components (Random coefficient Model of Turkey)

Random Effect	*Standard Deviation*	*Variance Component*	*df*	X^2	*p-value*
School Mean, U_0	54.93	3017.81	81	459.42	0.000
GOL, U_1	10.72	115.07	81	102.60	0.053
GBK, U_2	6.40	41.01	81	91.83	0.193
GED, U_3	7.38	54.54	81	101.16	0.064
GBO, U_4	14.10	198.87	81	86.51	0.317
GCA, U_5	7.03	49.44	81	105.96	0.033
MPA, U_6	6.58	43.42	81	76.53	>.500
MSC, U_7	10.75	115.61	81	110.88	0.015
GPB, U_8	7.29	53.23	81	70.00	>.500
Level-1 R	71.89	5169.56			

The variance explained at the student level can be examined by comparing the variances in the Analysis of Variance Model and the Random Coefficient Model. The comparison is completed by creating an index of the proportion of reduction in variance at the student level by comparing σ^2 estimates from these models.

$$\text{Proportion of variance explained Level-1} = \frac{\sigma^2(\text{ANOVA}) - \sigma^2(\text{RandomCoef.})}{\sigma^2\ (\text{ANOVA})}$$

$$\text{Proportion of variance explained at Level-1} = \frac{7324.76 - 5169.56}{7324.76} = 0.2942$$

By including these student level factors GOL, GBK, GED, GBO, GCA, MPA, MSC, GPB as predictors of mathematics achievement, within school variance was changed to 29.42%. Therefore these factors account for about 29.42% of the student level variances in mathematics achievement.

For the Random Coefficient Model, it is important to examine the variance of errors, τ_{qq} correlations. Tau as correlations obtained from random coefficient model of Turkey was given in Table 4.9. A high correlation indicates that essentially the same variation across the school level units is being carried and reduction in the model may be warranted by fixing one of the variables to be non-randomly varying. High τ_{qq} correlation was observed between the variables.

Table 4.7 Tau as Correlations (Random Coefficient Model of Turkey)

Tau (as correlations)									
INTRCPT1,B0	1.000								
GOL,B1	0.010	1.000							
GBK,B2	0.178	0.222	1.000						
GED,B3	-0.223	0.423	0.336	1.000					
GBO,B4	0.455	-0.446	0.345	-0.448	1.000				
GCA,B5	-0.034	0.023	-0.142	-0.417	-0.116	1.000			
MPA,B6	0.118	-0.300	-0.009	-0.429	0.510	0.151	1.000		
MSC,B7	-0.786	-0.020	-0.151	0.142	-0.333	0.209	-0.279	1.000	
GPB,B8	0.272	0.210	0.244	0.095	0.186	0.220	0.036	0.152	1.000

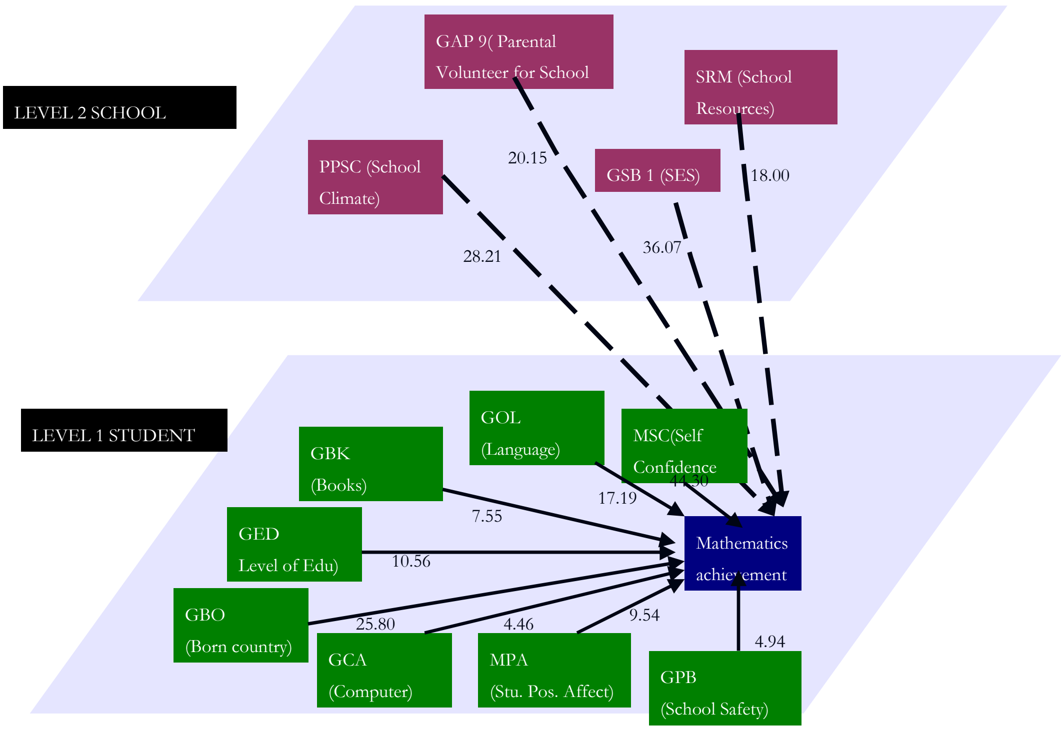
The reliability of the intercept and the randomly varying slopes can be estimated. The results provided from HLM analysis indicate that the intercept is quite reliable (0.725) and the slopes are far less reliable GOL=0.145, GBK=0.143, GED=0.148, GBO=0.085, GCA=0.184, MPA= 0.065, MSC= 0.190, GPB=0.094.The primary reasons, according to Bryk and Raudenbush (2002) for the lower reliability of the slopes are that the true slope variance of the true means and many schools may be relatively homogeneous on the randomly varying variables. Bryk and Raudenbush (2002) stated that coefficient reliabilities above .05 are acceptable.

There is significant difference between schools, even after the student-level predictors were hold constant these schools varied significantly in their mathematics achievement.

The proportions of variances explained by random coefficient models of mathematics achievement 29.42%

Figure 2 illustrates the model 2.

Figure 2 Model 2



4.2.4 Results of Research Question IV (Intercepts and Outcomes Model

The fifth question of HLM analyses for Turkey, provided information about which school characteristics influence the effect of student characteristics on the students' mathematics achievement in Turkey. In HLM, this research question is termed as Intercepts and Slopes as Outcomes Model.

For this research question, the coefficients (slopes) of the variables will be modeled. Simply, the variability in level-1 coefficients from students will be examined to ascertain if level-2 (school level) factors explain the variability. The coefficient is an indication of the amount of influence a variable has on the endogenous variable. The level-2 variables that are significantly associated with Level-1 factors are termed as cross level interactions. Traditionally, there is only one Level-2 equation for each Level-1 Beta value.

This research question incorporates with the first three questions and specifically examines randomly varying student level coefficients, slopes as outcomes that can be examined with school level variables. The first model was the mathematics achievement as determined from the Analysis of Variance Model (Research Question 1). The variability of mathematics achievement was modeled with school level variables in the Means as Outcomes Model (Research Question 2).

The model is an explanatory model to clarify how differences among schools characteristics might influence outcome distribution of mathematics achievement of Turkish students within schools.

Student level variables or coefficients were observed to be randomly varying in the Random Coefficient Model (Research Question 4). Due to this variability, these two coefficients becomes as modeled with school level variables, i.e., randomly varying coefficients becomes as model. The school level variables that are observed to be significantly related to the random coefficients are termed as cross-level interactions. This simply means that a school level variable influences a student level slope.

The process of determining the final Intercept and Slopes as Outcomes Model begins with the results from the Random Coefficient Model (Research Question 3). The first step was to replicate the Means as Outcomes Model (Research Question 2) and include the significant student level variables from the Random Coefficient Model (Research Question 3).The full model Intercepts and Slopes as Outcomes Model was analyzed according to group centered and grand centered means at school level variables and student level variables was group mean centered..

Level-1 Model

Mathematics Achievement= $\beta_0 + \beta_1*(GOL) + \beta_2*(GBK) + \beta_3*(GED) + \beta_4*(GBO) + \beta_5*(GCA) + \beta_6*(MPA) + \beta_7*(MSC) + \beta_8*(GPB) + r_{ij}$

Level-2 Model:

$\beta_0 = \gamma_{00} + \gamma_{01}*(GSB\text{-}1) + \gamma_{02}*(GAP\text{-}9) + \gamma_{03}*(SRM) + \gamma_{04}*(PPSC) + \upsilon_0$

$\beta_1 = \gamma_{10} + \gamma_{11}*(PPSC) + \upsilon_1$

$\beta_2 = \gamma_{20} + \gamma_{21}*(GSB\text{-}1) + \upsilon_2$

$\beta_3 = \gamma_{30} + \gamma_{31}*(GSB\text{-}1) + \upsilon_3$

$\beta_4 = \gamma_{40} + \gamma_{41}*(SRM) + \upsilon_4$

$\beta_5 = \gamma_{50} + \gamma_{51}*(SRM) + \upsilon_5$

$\beta_6 = \gamma_{60} + \gamma_{61}*(GAP\text{-}9) + \upsilon_6$

$\beta_7 = \gamma_{70} + \upsilon_7$

$\beta_8 = \gamma_{80} + \upsilon_8$

Table 4.8 are displayed the Tau correlations between the Level-1 variables. The negative correlations between some intercepts and slopes of the Level-1 predictors indicated that if mathematics achievement high, the effects of negative correlations in those schools are smaller.

A high correlation indicates that essentially the same variation across the student level units is being carried and reduction in the model may be warranted by fixing one of the variables to be non-randomly varying. High τ_{qq} correlation was observed between the variables. Table 4.8 shows the correlation values of the Level 1 variables.

Table 4.8 Tau Correlations

Tau (as correlations)
INTRCPT1,B0 1.000
GOL,β_1 0.255 1.000
GBK, β_2 0.082 0.235 1.000
GED, β_3 0.021 0.338 0.394 1.000
GBO, β_4 0.171 -0.139 0.576 -0.134 1.000
GCA, β_5 0.056 0.017 -0.085 -0.498 -0.154 1.000
MPA, β_6 0.219 -0.318 0.013 -0.367 0.417 0.126 1.000
MSC, β_7 -0.702 -0.029 -0.100 0.003 -0.214 0.163 -0.391 1.000
GPB, β_8 0.091 0.341 0.256 0.142 0.085 0.161 -0.008 0.342 1.000

Table 4.9 shows the reliability estimates of the Level 1 variables. The reliability of the intercept and the randomly varying slopes can be estimated. The results provided from HLM analysis indicate that the intercept is quite reliable (0.643) and the slopes are far less reliable GOL=0.120, GBK=0.149, GED=0.134, GBO=0.045, GCA=0.188, MPA= 0.067, MSC= 0.178, GPB=0.084.The primary reasons, according to Bryk and Raudenbush (2002) for the lower reliability of the slopes are that the true slope variance of the true means and many schools may be relatively homogeneous on the randomly varying variables. Bryk and Raudenbush (2002) stated that coefficient reliabilities above .05 are acceptable.

Table 4.9 Reliability Estimates

Random Level-1 coefficient	Reliability Estimate
INTRCPT1, β_0	0.643
GOL, β_1	0.120
GBK, β_2	0.149
GED, β_3	0.134
GBO, β_4	0.045
GCA, β_5	0.188
MPA, β_6	0.067
MSC, β_7	0.178
GPB, β_8	0.084

Table 4.10 The Final Estimation of the Fixed Effects of Final Full Model

Fixed Effect	Coefficient	Standard Error	Approx. T-ratio	d.f.	*p*-value
For INTRCPT1, β_0					
INTRCPT2, γ_{00}	435.07	4.03	107.95	141	0.000
GSB-1, γ_{01}	-18.78	4.94	-3.80	141	0.000
GAP-9, γ_{02}	-20.51	8.43	-2.43	141	0.015
SRM, γ_{03}	-12.52	6.65	-1.88	141	0.059
PPSC, γ_{04}	-18.91	7.56	-2.50	141	0.013
For GOL slope, β_1					
INTRCPT2, γ_{10}	-17.04	3.05	-5.58	20	0.000
PPSC, γ_{11}	6.99	4.03	1.73	68	0.083
For GBK slope, β_2					
INTRCPT2, γ_{20}	7.48	1.40	5.33	141	0.000
GSB-1, γ_{21}	-1.44	1.41	-1.02	135	0.307
For GED-1 slope, β_3					
INTRCPT2, γ_{30}	-10.31	1.56	-6.58	144	0.000

GSB-1, γ_{31}	2.20	1.43	1.54	144	0.122
For GBO slope, β_4					
INTRCPT2, γ_{40}	-27.60	4.80	-5.74	25	0.000
SRM, γ_{41}	-16.32	7.06	-2.31	38	0.026
For GCA slope, β_5					
INTRCPT2, γ_{50}	-4.17	1.49	-2.80	66	0.006
SRM, γ_{51}	3.8	2.11	1.81	144	0.069
For MPA slope, β_6					
INTRCPT2, γ_{60}	-9.84	1.98	-4.96	130	0.000
GAP-9, γ_{61}	-4.05	3.77	-1.07	144	0.283
For MSC slope, β_7					
INTRCPT2, γ_{70}	-44.12	1.90	-23.16	145	0.000
For PPSC slope, β_8					
INTRCPT2, γ_{80}	-4.83	1.79	-2.69	145	0.007

The results of the final estimation of fixed effects obtained from the full final Intercepts and Slopes as Outcomes Model of Turkey were presented at Table 4.10. Students speak the language of test (GOL), books in home (GBK), highest level of education (GED), students parents born in country (GBO), computer use (GCA), students positive affect (MPA), self-confidence (MSC), school safety PPSC are significantly related to mean of school mathematics achievement. GSB-1 coefficient (γ_{01}= -18.78, se=4.94) indicates that GSB-1 is related with mathematics achievement. The parent volunteer for school progress (GAP-9) coefficient (γ_{02}= -20.51, se=8.43) is related with mathematics achievement. The school resources (SRM) coefficient (γ_{03}= -12.52, se=6.65) is related with mathematics achievement. The school climate (PPSC) coefficient (γ_{04}= -18.91, se=7.56) is related with school mathematics achievement.

As stated previously, the results from the Random Coefficient Model are reported in the final full intercepts and Slopes as Outcomes Model as well. Students speak the language of test (GOL),), books in home (GBK), highest level of education (GED), students parents born in country (GBO), computer use (GCA), students positive affect (MPA), self-confidence (MSC), school safety PPSC are significantly related with mathematics achievement.

GOL slope coefficient (γ_{10}= 17.04, se=3.05) is related to mathematics achievement. Students' speak the language of test variable is related with school's PPSC variable (γ_{11}=6.99, se= 4.03). Books in home slope coefficient (γ_{10}= 7.48, se=1.40) is related to mathematics achievement. Students' books in home variable is related with school's socio economic status variable (γ_{21}=-1.44, se=1.41). Highest level of education of either parent slope coefficient (γ_{30}=-10.31, se= 1.56) is related with mathematics achievement. Students' Highest level of education of either parent variable is related with school's socio economic status variable (γ_{31}=2.20, se=1.43). Students parents born in country slope coefficient (γ_{40}=-27.60, se=4.80) is related with mathematics achievement. Students parents born in country variable is related with school's school resources variable (γ_{41}=-16.32, se=7.06). Computer use slope coefficient (γ_{50}=-4.17, se=1.49) is related with mathematics achievement. Students' computer use variable is related with school resources variable (γ_{51}=3.8, se=2.11). Students' positive affect slope coefficient is (γ_{60}=-9.84, se=1.98) related with mathematics achievement. Students positive affect variable is related with parent volunteer for school progress variable (γ_{61}=-4.05, se=3.77). Self confidence slope coefficient is (γ_{60}=-44.12, se=1.90) related with mathematics achievement. School climate slope coefficient is (γ_{80}= -4.83, se=1.79= related with mathematics achievement.

The results of the final estimation of variance components obtained from the full final Intercepts and Slopes as Outcomes Model of Turkey were presented in Table 4.14. The degrees of freedom for this model (Intercepts and Slopes as Outcomes Model) is based on the number of schools with sufficient data, and the number of school related factors included in the study.

Table 4.11 Final Estimation of Variance Components

(Final Full Model of Turkey)

Random Effect	*Standard Deviation*	*Variance Component*	*df*	X^2	*p-value*
INTRCPT1,U0	42.26	1786.26	77	282.02	0.000
GOL, U_1	9.45	89.41	80	97.74	0.087
GBK, U_2	6.49	42.19	80	90.73	0.193
GED, U_3	6.91	47.81	80	97.24	0.092
GBO, U_4	9.56	91.41	80	84.11	0.354
GCA, U_5	7.11	50.55	80	102.53	0.045
MPA, U_6	6.55	42.95	80	76.01	>.500
MSC, U_7	10.35	107.13	81	110.75	0.016
PBSC, U_8	6.62	43.90	81	70.76	>.500
Level-1,R	71.91	172.40			

64 of the schools did not have sufficient data to be included, so 64 schools were not used in this analysis. The proportion of variance explained for each achievement slope model with significant school level variables could be examined. The equation is:

$$\text{The Proportion of Variance Explained in } \beta qj = \frac{\tau_{qq}(\text{RandomCoef.})\text{-}\tau_{qq}(\text{FullModel})}{\tau_{qq}(\text{RandomCoef.})}$$

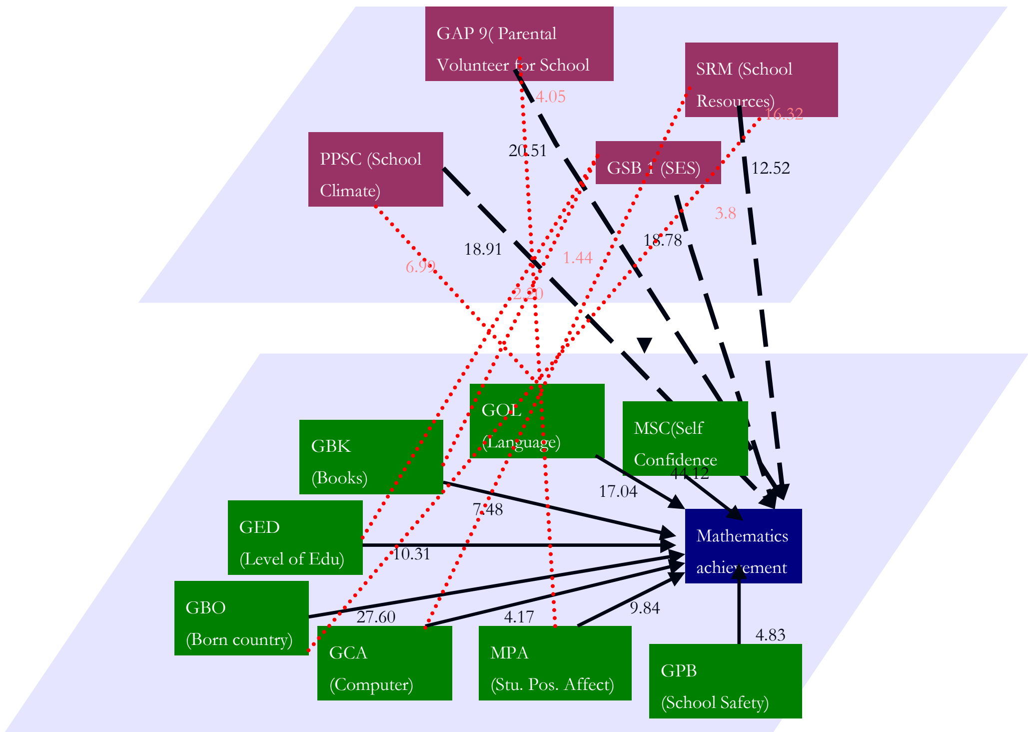
βqj =Mathematics achievement or the slope of coefficient for a given variable

$$\text{The Proportion of Variance Explained in } \beta_{0j} = \frac{3017.81-1786.25}{3017.81} = 0.4081$$

The value (0.4081) lower than the one observed in the results Means and Outcomes Model and it was a result of the differences in the samples between two models. Furthermore, 10% reduction in the variance was accounted for other variables. Both of these proportions showed that amount of variation had been accounted for.

Figure 3 illustrates the Model 3.

Figure 3 Model 3



4.3 Summary of Results

- 45 % of the variance in mathematics achievement is among schools.
- 54.63 % of the variance in mathematics achievement is within schools
- Mathematics achievement score of the Turkish students were predicted by the school variables of SES, parent volunteer for school progress, school recourses, and school climate in the means-as-outcome model. The proportion of variance explained by means-as-outcome model of Turkish students' mathematics achievement was 57.33%.
- Student level factors students speak the language of test, books in home, highest level of education level of either parent, students parents born in country, computer use, students positive affect, self confidence, school safety as predictors of mathematics achievement, within school variance was changed to 29.42%.
- 40.81% of variance of students' mathematics achievement depends on the school variables of SES, parent volunteer for school progress, school resources, and school climate when student level variables students speak the language of test, books in home, highest level of education level of either parent, students parents born in country, computer use, students positive affect, self confidence, school safety were controlled.

CHAPTER 5

CONCLUSIONS

This chapter of thesis is dedicated to the discussions of the results of the present study. Six main sections such as summary of the study, discussion of the results, conclusions drawn on the discussed results, implications of the study, limitations of the study and recommendations for further researchers were included in this chapter. The present study was summarized in the first section. In the discussions of the results section the student and school level factors and the student and teacher level factors included in the study were discussed in compatible with the literature across Turkey. In conclusions section, the results of the study were interpreted across Turkey. In implications of the study were stated in accordance with conclusions. The limitations of the study were examined in the limitations section and recommendations were indicated for further researchers were presented in the recommendations section.

5.1 Summary of the Study

The purpose of the study was to expand the understanding of the student and school level factors, the interactions of these two levels and their impact on students' mathematics achievement. Schools are the important part of the teaching since students and teacher spend most of their time at school. Apart from students and teachers, school administrations and parents and the environment of the school are affecting students' learning environment. Within the education system, these school, and student factors affect achievement more or less.

In the present study, it was aimed to understand whole picture of student, and school factors and their interactions with students' mathematics achievement across Turkey through the Trends of International Mathematics and Science Study 2007. Previous studies ignored the two level interactions, and nested structure of the data, bias in ignoring the estimating coefficients and standard errors. Therefore, the present study deals with these ignored parts by using the multilevel analysis technique that takes into account the nested structure with unbiased in estimating the coefficients and standard errors.

The present study investigated the student and school level factors that influenced 13-14 year old students' mathematics achievement across Turkey using Hierarchical Linear Modeling (HLM) as a multilevel analysis technique and a large public database (TIMSS). The models given in the literature were supplied a theoretical framework for identifying the student and school level factors as: principals' report on the percentage of students in their schools coming from economically disadvantaged homes, good attendance, principals' time spend on various school related activities, school's encouragement of parental involvement, school resources for mathematics instruction, principals perception of school climate. Student variables was set as a controlling variables due to high correlation with mathematics achievement while the outcome variable was the five plausible mathematics scores.. Students predictors is highest level of education of either parent, students speak the language of test at home, students parents born in country, books in home, computer and internet connection in home, computer use, time spend doing mathematics homework in a normal school week, students positive affect toward mathematics, students valuing mathematics, students self confidence in learning mathematics. The findings and implications were based on the results on the final full model which was the Intercepts and Slopes as Outcomes Model carried out for Turkey.

5.2 Discussion of Results

The discussions of the results in this section of the thesis were presented in two main sections: Student-Level Factors and School Level Factors. It is reminded that the discussion of the results was stated at six parts for Turkey.

5.2.1 Student Level Factors

Eight variable slopes (students speak the language of test, books in home, highest level of education level of either parent, students parents born in country, computer use, students positive affect, self confidence, school safety) were significantly related to mathematics achievement and randomly varying across schools of Turkey.

Students speak the language of test was significantly related to mathematics achievement. That is, students who speak the language of test at home were shown more mathematics achievement than students who do not speak the language of test at home. This result is consistent with results of the previous studies. This was the expected result since if student speak the language of test at home they can learn issues, they can analyze the meanings of words so mathematics in deep so they show more mathematics achievement. Ismail & Awang (2008) found no significant difference in the odds ratio when comparing students who are medium achievers and low achievers between students who always speak the language of the test at home and those who do not while the difference were significant when comparing between the medium and high achievers with the low achievers

As stated previously, the magnitude of the relationship between speaks the language of test at home and mathematic achievement significantly varies from school to school. The reasons for that difference among schools are unknown since there are a lot of factors affecting that difference among schools. This research does not attempt to explain why the impacts of the student level factors are bigger among some schools than others. Further studies are needed to investigate the differences among schools with respect to significant student factors.

Second varying slope books in home was found as a significant factor having positive effect on mathematics achievement. That is, students who have more books in her home were shown more mathematics achievement than students who have fewer books in her home. This result is consistent with results of the previous studies. This was the expected result since if student have more books, their families socio economic status were higher than other students. So, their families can reach the books and other materials easily. They can learn issues, they can search these books so they show more mathematics achievement. More books means more exercises for practice, and one can only get better at calculations with lots of practice. Ismail & Awang (2008) verified with the Malaysian students data form TIMSS 99 that that students obtained higher mathematics scores when they have more books at home.

As stated previously, the magnitude of the relationship between having more books in home and mathematic achievement significantly varies from school to school. The reasons for that difference among schools are unknown since there are a lot of factors affecting that difference among schools. As stated the students speak the language of test, this research does not attempt to explain why the impacts of the student level factors are bigger among some schools than others. Further studies are needed to investigate the differences among schools with respect to significant student factors.

Third varying slope highest level of education of either parent was found as a significant factor having positive effect on mathematics achievement. This result showed that, students whose parents have higher education level have higher mathematics achievement than students whose parents' education level do not higher. This was consistent with Ismail & Awang (2008) findings. Ismail & Awang (2008) stated that students from well educated parents are associated with higher probability of high mathematics performance. Better educated parents are able to guide their children in appreciating what they learn, how to learn it, and they can constantly monitor their progress.

The magnitude of the relationship between higher level of education of parents and mathematics achievement significantly varies from school to school. Highest education level of parents was affected by mathematics achievement more in same schools than other schools. As stated number of books, students speak the language of test at home, the present study, did not attempt to explain why the effect of number of books and students speak the language of test at home, higher level of education of parents are greater in some schools in than other schools.

Fourth varying slope students parents born in country, students' parents born in the country, was found a significant factor having effect on the mathematics achievement. Students whose parents born in the country have higher achievement levels than student whose parents were not born in the country. This result was consistent with the previous research findings. In fact, Students' parents born in the country is closely interrelated to mathematics achievement. Therefore, that supplies a potential effect on mathematics achievement.

Fifth varying slope, use of computer, was found significant factor affecting mathematics achievement. Usages of computers affect mathematic achievement. Students who use computer herself showed higher level of mathematics achievement than students who do not use computer herself or less usage of computer at school. Ismail & Awang (2008) stated computer usage has the highest impact on students' mathematics score. In point of fact, computer usage is related with their mathematics achievement levels. Learning using computers makes it easier for students to visualize and understand mathematics concepts in a much shorter time. In conclusion that has affect on students' mathematics achievement.

Sixth varying slope, (MPA) students' positive affect toward mathematics was found significant factor affecting mathematics achievement. It has a positive effect. Students who have positive affect toward mathematics have got higher achievement levels than students who do not have positive affect toward mathematics. Ismail & Awang (2008) indicated the biggest influence comes from self-confidence in learning mathematics. In the point of fact, students' positive affect toward mathematics is related with mathematics course. In conclusion, that positive affect toward mathematics has an effect on students' mathematics achievement.

Seventh varying slope, (MSC) students' self confidence in learning mathematics, was found significant factor affecting mathematics achievement. This factor affects students' mathematics achievement positively. Higher self confidence in learning mathematics was related with the mathematics achievement. As Papanastasiou (2002) stated, there was a positive relation between attitudes towards mathematics and mathematics achievement. Self-confidence affected positively Iranian students' mathematics achievement in Kiamanesh (2004) study. Students self confidence level affect their mathematics achievement at developing or developed countries. Moreover, Howie (2002) found that students with higher self-concepts and students, who valued the importance of mathematics, were more likely than their peers with low self-concepts to attain higher mathematics performance.

Eight varying slope, (GPB) students perception of being safe in school, was found significant factor affecting mathematics achievement. This factor affects positively the mathematics achievement. Higher achievement levels related with lower levels of students perception of being safe in school. Papanastasiou (2002) showed that school climate was influenced by the educational background of students and school climate in turn influences teaching. Kiamanesh (2004) found school climate was not related with the mathematics achievement for Iranian students.

The reasons of why these slopes varied randomly among schools are difficult to provide. The analysis technology of hierarchical linear modeling is new and only recently has the chance of answer to whether effect of variables vary from school to school or not. To answer the causes of varying slopes among schools, more complete data and more sensitive analyses are needed.

5.2.2 School Level Factors

School related predictors were significantly related to a student level slope. Therefore, there was cross-level interaction in hierarchical linear model of the Turkey.

When the school level predictors were significantly related to mathematics achievement in Turkey, four school level factors were obtained: principals reports on the percentage of students in their schools coming from economically disadvantaged homes, parents volunteer for school programs, school resources for mathematics instruction, principals perception of being safe in school.
Principals' reports on the percentage of students in their schools coming from economically disadvantaged homes contacted with the mathematics achievement. This negative contact is robustly linked with mathematics achievement which is supported with previous results of literature. Lytton and Pyryt (1998) have shown that in Canada between 35% and 50% of the variation in elementary students' academic achievement can be attributed to SES.

While predictor about school characteristics was considered, parents volunteer for school programs was found significantly related to mathematics achievement. Positive linkage between parents volunteer for school programs and mathematics achievement was monitored. This result is consistent with past research. Students learn more and perform better in schools that have strong parental involvement (Goldring & Shapira, 1996; Ho & Willms, 1996).

When school resources for mathematics instruction were considered, school resources for mathematics instruction were found significantly related to mathematics achievement. This positive linkage between parents support and mathematics achievement was observed at the study was consistent with the previous findings of Kiamanesh (2008). Kiamanesh found significant affect of teaching aids on mathematics achievement. Ownership of study aids provides students with the necessary tools for learning mathematics especially when it involves a lot of calculations.

When principals’ perception of being safe in school on students’ achievement was considered, principals’ perception of being safe in school was found significantly related to mathematics achievement. This positive linkage between, principals perception of being safe in school and mathematics achievement was observed at the study was consistent with the previous findings. That result contradicts with Akiba’s research results (2008). Akiba (2008) found no consistent finding regarding socioeconomic status and academic achievement of students; these factors were not significantly associated with students’ fear. Socioeconomic status and academic achievement level are not perceived by students as vulnerable characteristics for violence victimization in a majority of countries examined at study.

Overall, principals’ reports on the percentage of students in their schools coming from economically disadvantaged homes, parents volunteer for school programs, school resources for mathematics instruction, principals’ perception of being safe in school were significantly related with mathematics achievement.

5.3 Conclusions

Aim of the study was to get an understanding of the school level factors and their interactions on students' mathematics achievement across Turkey through the Trends in International Mathematics and Science Study (TIMSS) 2007.

The conclusions of the results were offered in this section of the thesis. The results of the present study were summarized. At the student level, students speak the language of test at home, number of books in home, highest level of education of parents, students' parents born in country, computer usage, students' positive affect toward mathematics, students valuing mathematics, students' perception of being safe in school was significantly related with mathematics achievement. At the school level, principals' reports on the percentage of students in their schools coming from economically disadvantaged homes, parents volunteer for school programs, school resources for mathematics instruction, principals' perception of being safe in school were significantly related with mathematics.

HLM separates variation in school variables into between-student and between-school and then analyzes each component in relation to the other. Hence, HLM can offer better statistical adjustments and more accurate estimations and promote better policies and practices.

5.4 Implications

Identifying the characteristics of the under achiever students, schools might help to educators, planners, to determine the priorities. On the other hand, determining the characteristics of the high achiever students gives clue for what to do for low achiever students. The results of the study give suggestions for improving mathematics education in Turkey.

Parental involvement is important for students' mathematics achievement but school administrators do not include parents effectively or parents were less likely to involve schools activities. Parents' socio-economic status has a negative factor on parental involvement at schools. Parents with higher socio-economic status neither give feedback to schools administration, but their working conditions usually nor allowed them to participate regularly to school activities.
Parental involvement should be satisfied with the social activities not the instructional activities.

School safety and safety learning environments is major responsibility of the educators. Students should go to school without fearing. Ensuring safety learning environments is major responsibility of school administration and educators. Educators should know that disorderly climate is affecting not only those who are directly involved but many others who are exposed to chaotic environment by increasing their level of panic.
Policy makers should support parent involvement at school. Parents should be a part of school community.
Policy makers should give importance to school climate. Since a positive environment affects students attitude toward mathematics and indirectly mathematics achievement.

5.5 Limitations of the Study

Aim of the study was to get an understanding of the school level factors and their interactions on students' mathematics achievement across Turkey through the Trends in International Mathematics and Science Study (TIMSS) 2007. Hierarchical linear modeling technique was used as a multilevel analysis technique; the present study is an associational nature. Because of the nature of the hierarchical linear modeling, study does not give much information about the causes and effects of the relationships gotten.

The measurement of the student level variables and school level variables which were used at the study might be limitation of the study. Since the validity and reliability of the measurement of school and student variables might be unreliable. The reason is that, the study is a part of international study and some of the variables might not be reflect the exact ones. One of the incorrectly measured variables gives incorrect relationships between variable and mathematics achievement. One imprecise variable affects other variables coefficients, standard deviations.

One more limitation can be affirmed as lack of school, and student variables. Results of the study showed a great deal of variance by adding or reducing variables from the study. Some of variables could be added and give much more information about school. To illustrate school social activities gives valuable information about the school social climate. Teaching patterns and teaching activities gives also valuable information about the students' achievement. By considering these two aspects for school variables, how much unaccounted variance would have been absorbed by school level is actually unknown.

Reduced degrees of freedom can also be limitation of the study. The reduction of the degrees of freedom reduces validity of the study. Since the research questions were analyzed with different samples.

Application of the hierarchical linear modeling is fairly new used at educational research. There is little information about the assumptions and effects of these assumptions on the results.

One more limitation is the model specification. Hierarchical linear modeling does not examine the bi-directional relationship as structural equation modeling. Because of that bidirectional relationship were not examined in the study.

Student variables were not randomly varying with the school and teacher variables.

5.6 Recommendations for Further Researchers

Profundity research is needed to examine reasons of the relationships obtained in the study.

Further research should be conducted to explore the underlying reasons of the relationships between mathematics achievement and selected student level factors and selected school related factors.

The study was used the student and school variables and mathematics achievement as an outcome variable obtained from TIMSS 2007.The same research could be conducted with the upcoming TIMSS data. So, all of the results could be tested again on different samples selected from participating countries

REFERENCES

Akiba, M., (2008), Predictors of student fear of school violence: a comparative study of eighth graders in 33 countries', School Effectiveness and School Improvement,19:1,51 — 72

Akyüz, G., (2006),Investigation of The Effect of Teacher and Class Characteristics on Mathematics Achievement in Turkey and European Union Countries, Elementary Education Online, 5(2), 75-86, 2006.

Alacacı,C., Erbaş, A.K., (2009), Unpacking the inequality among Turkish schools: Findings from PISA 2006, International Journal of Educational Development.

Antonijević, R., (2004) Usage Of Computers And Calculators And Students' Achievement: Results From TIMSS 2003

Antonijević, R., (2004) Mathematics Achievement Of Serbian Eighth Grade Students And Characteristics Of Mathematics Curriculum

Betts, J., & Shkolnik, J. L. (1999). The behavioral effects of variations in class size: The case of math teachers. Educational Evaluation and Policy Analysis,21(2), 193–214.

Blakey, L.S., and Heath, A.F. (1992). "Differences Between Comprehensive Schools: Some PreliminaryFindings." In D. Reynolds and P. Cuttance (Eds.) School Effectiveness: Research, policy and practice. London: Cassell.

Birenbaum, M., Tatsuoka, C.and Xin, T. Large-scale diagnostic assessment: comparison of eighth graders' mathematics performance in the United States, Singapore and Israel, Assessment in Education Vol. 12, No. 2, July 2005, pp. 167–181

Burstein, L. (1993). The IEA Study of Mathematics III: Student growth and classroom Processes. Oxford: Pergamon Press.

Bourke, S. (1986). How smaller is better: Some relationships between class size, teaching practices, and student achievement. American Educational Research Journal, 23, 558–571.

Campbell, M.N., Abbot, J.G., (1976) Botswana's Primary School System: A Spatial Analysis, Gaborone: Institude of Development Management.

Chernichovsky, 1985 D. Chernichovsky, Socio-economic and demographic aspects of school enrolment and attendance in rural Botswana, In Economic Development and Cultural Change 33 (1985), pp. 319–332.

Coleman, J. (1966). Equality of Educational Opportunity. Washington, U.S. Government Printing Office.

Cooper, H. (1994). The battle over homework: An administrator's guide to setting sound and effective policies; the practicing administrator's LEA. Microfiche.

De Jong R.; Westerhof K.J.; Creemers B.P.M. (2000), Homework and Student Math Achievement in Junior High Schools, Educational Research and Evaluation , Vol. 6, No. 2, pp. 130–157

Goldring, E .B. & Shapira, R., (1996), Principals' survival with parental involvement. School Effectiveness and School Improvement, 7,342-360.

Howie, S., (2002). English language proficiency and contextual factors influencing mathematics achievement of secondary school pupils in South Africa. Enschede, The Netherlands: Print Partners Ipskamp.

Finn, J. D., & Achilles, C.M., (1999). Tennessee's class size study: Findings, implications, misconceptions. Educational Evaluation and Policy Analysis, 21(2), 97–110.

Finn, J. D., Pannozzo, G. M., & Achilles, C., (2003). The "why's" of class size: Student behavior in small classes. Review of Educational Research, 73, 321–368.

Greenwald, B., Hedges, L.V., Laine, R.D., The Effect of School Resources on Student Achievement, Review of Educational Research, Vol. 66, No. 3 (Autumn, 1996), pp. 361-396.

Ismail, N.A. & Awang, H., (2008), Differentials in Mathematics Achievement Among Eighth-Grade Students In Malaysia, International Journal of Science and Mathematics Education, 6, 559-571

Ismail, N.A. & Awang, H., (2008), Assessing the Effects of Students' Characteristics and Attitudes on Mathematics Performance, Problems of Education in 21st Century, Volume 9, 2008.

Hammouri, H., (2004)'Attitudinal and motivational variables related to mathematics achievement in Jordan: findings from the Third International Mathematics and Science Study (TIMSS)',Educational Research,46:3,241 — 257

Harmon et al., 1997 M. Harmon, T.A. Smith, M.O. Martin, D.L. Kelly, A.E. Beaton, I.V.S. Mullis, E.J. Gonzalez and G. Orpwood, Performance Assessment in IEA's Third International Mathematics and Science Study (TIMSS), Boston College, Chestnut Hill, MA (1997).

Ho, S., & Willms, J. D. (1996). Effects of parental involvement on eighth-grade achievement. Sociology of Education,69 , 126-141.

Kiamanesh, A.R. (2004). Factors Affecting Iranian Students' Achievement in Mathematics, Paper presented in the First IEA International Research Conference, Cyprus.

Krueger. A. B. (1999), 'Experimental estimates of education production functions'. Quarterly Journal of Economics, Vol. 114, pp. 497-532.

Kozma, R.,B., Technology and Classroom Practices: An International Study, Journal of Research on Technology in Educatio, Volume 36 Number 1.

Lee, E. V., and Loeb, S., School Size in Chicago Elementary Schools: Effects on Teachers' Attitudes and Students' Achievement

,American Educational Research Journal, Vol. 37, No. 1, (Spring, 2000), pp. 3-31.

Lee, V., & Smith, J. (1995). Effects of high school restructuring and size on early gains in achievement and engagement. Sociology of Education, 68, 241–270.

Lytton, H., & Pyryt, M., (1998), Predictors of achievement in basic skills: A Canadian effective schools study. Canadian Journal of Education, 23 , 281-301.

Jencks, C. S., Smith, M., Acland, H., Bane, M. J., Cohen, D., Ginter, H., Heyns, B., and Michelson, S. (1972). Inequality: A Reassessment of the Effect of the Family and Schooling in America. New York: Basic Books.

Jürges H., Schneider K. (2004). International differences in student achievement: An economic perspective. German Economic Review, Vol. 5 (3), pp. 357 – 380.

M. Harmon, T.A. Smith, M.O. Martin, D.L. Kelly, A.E. Beaton, I.V.S. Mullis, E.J. Gonzalez and G. Orpwood, Performance Assessment in IEA's Third International Mathematics and Science Study (TIMSS), Boston College, Chestnut Hill, MA (1997).

Ma,X., (2001), Stability of Socio-economic Gaps in Mathematics and Science Achievement Among Canadian Schools, Canadian Journal of Education, 26, 97–118.

Ma, X., & Klinger, D. A., (2000). Hierarchical linear modeling of student and school effects on academic achievement. Canadian Journal of Education, 25, 41–55.

Milesi, C., Gamoran, A., Effects of Class Size and Instruction on Kindergarten Achievement, Educational Evaluation and Policy Analysis, 2006; 28; 287

Mikk, J., (2006)Economic and educational correlates of TIMSS results, Social Research ,7

Muijs, Daniel and Reynolds, David(2003)'Student Background and Teacher Effects on Achievement and Attainment in Mathematics:

A Longitudinal Study, Educational Research and Evaluation,9:3,289 — 314.

Mullis,I.V.S., Martin,M.O., Foy, P., (2008), TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades.

Neuwahl, N.M.E., & Van den Bogaart, P.H.M., (1984). Enkele onderwijspsychologische aspecten van huiswerk [Some psychological educational aspects of homework]. Pedagogische Studien, 61(7/8), 296–303.

Nye, B. A., Hedges, L. V., & Konstantopoulos, S. (2002). Do low-achieving students benefit more from small classes? Evidence from the Tennessee Class Size Experiment. Educational Evaluation and Policy Analysis, 24, 201–217.

O'Dwyer L. M. Examining the variability of mathematics performance and its correlates using data from TIMSS '95 and TIMSS '99. Educational Research and Evaluation, Vol. 11 (2), pp. 155 – 177.

Olson, J.F., Martin, O.M., Mullis, I.V.S., (2007), TIMSS 2007 Technical Report

Papanastasiou, C. (2000) Internal and External Factors Affecting Achievement in Mathematics: Some Findings From TIMSS. Studies in Educational Evaluation, 26, l—7.

Papanastasiou, C. (2002). School, teaching and family influence on student attitudes toward science: Based on TIMSS data Cyprus. Studies in Educational Evaluation, 28, 71–86.

Pelgrum, W. & Plomp, T. (2002). Indicators of ICT in mathematics: Status and covariation with achievement measures. In A.E. Beaton & D.F. Robitaille (Eds), Secondary analysis of the TIMSS data.

Phan, H.T., (2008), Building Mathematics-Achievement Models for Developed and Developing Countries: An Application of SAS® to Large-Scale, Secondary Data Management and Analysis, SAS Global Forum 2008

Philips, M., (1997), What Makes Schools Effective? A Comparison of the Relationships of Communitarian Climate and Academic Climate to Mathematics Achievement and Attendance during Middle School, American Educational Research Journal, Vol. 34, No. 4, pp. 633-662.

Pong, S., & Pallas, A. (2001). Class size and eighth-grade math achievement in the United States and abroad. Educational Evaluation and Policy Analysis, 23(3), 251-273.

Ramirez, M.J., (2005) Attitudes Toward Mathematics And Academic Performance Among Chilean 8th Graders, Estudios Pedagógicos, 31, Volume 1, 97-112.

Ramirez, M.J., (2006), Understanding the low mathematics achievement of Chilean students: A cross-national analysis using TIMSS data International Journal of Educational Research, 45 102–116.

Raudenbush, S. W., Bryk, A., Cheong, Y. F., & Congdon, R., (2001). HLM5: Hierarchical linear and nonlinear modeling. Chicago, IL: Scientific Software International, Inc.

Raudenbush, S. W., & Bryk, A. S., (2002). Hierarchical linear models: Applications and data analysis methods. CA: Sage Publications, Inc.

Rodriguez, M. C., (2004)'The Role of Classroom Assessment in Student Performance on TIMSS', Applied Measurement in Education, 17, 1-24

Stasz, C., & Stecher, B. M., (2000). Teaching mathematics and language arts in reduced size and non-reduced size classrooms. Educational Evaluation and Policy Analysis, 21, 313–329.

Schmitt N., Sacco J. M., Ramey S., Ramey C., Chan D. (1999). Parental employment, school climate, and children's academic and social development. Journal of Applied Psychology, Vol. 84, Issue 5, pp. 737-753.

Sukon, K.S., Jawahir, R.,(2005) Influence of Home-related factors in Numeracy Performance of Fourth-Grade Children in Mauritius, International Journal of Educational Development, 25, 547-556.

Trautwein, U., K¨ oller, O., Schmitz, B., and Baumert, J. (2002). Do homework assignments enhance achievement? A multilevel analysis in 7th-grade mathematics. Contemp. Educ. Psychol. 27: 26–50.

Van der Sanden, J.M.M.(Ed.). (1987). Huiswerk en huiswerkbeleid. [Homework and homework policy]. Amsterdam/Lisse: Swets & Zeitlinger.

Yayan,B., Berberoğlu, G., (2004), A Re-Analysis of the TIMSS 1999 Mathematics Assessment Data of the Turkish Students, Studies in Educational Evaluation 30 (2004) 87-104.

Zhao, H. & Akiba, M., (2007), School expectations for parental involvement and student mathematics achievement: a comparative study of middle schools in the US and South Korea, Compare: A Journal of Comparative and International Education.

Wagemaker, H. (2002) TIMSS in context: assessment, monitoring, and moving targets, in: D. F.Robitaille & A. E. Beaton (Eds) Secondary analysis of TIMSS data (Dordrecht, Kluwer), 3–10.

Walberg, H.J., & Paschal, R.A. (1995). Homework. In L.W. Anderson (Ed.),International Encyclopaedia of Teaching and Teacher Education (pp. 268–271). Oxford: Elsevier.

Wenglinski, H. (1998). Does it compute? The relationship between educational technology and student achievement in mathematics. Princeton, NJ: ETS.

APPENDIX A

DESCRIPTIVE STATISTICS

LEVEL-1 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MIN.	MAX.
IDBOOK_1	4498	7.52	4.02	1.00	14.00
GOL_1	4498	1.36	0.70	1.00	4.00
GBO_1	4498	2.37	1.12	1.00	5.00
GTH_2	4498	1.54	0.49	1.00	2.00
GTH_5	4498	1.77	0.42	1.00	2.00
MAT_1	4498	438.12	111.71	112.41	830.56
MAT_2	4498	436.91	112.84	109.71	836.41
MAT_3	4498	437.60	112.79	114.45	885.78
MAT_4	4498	437.10	113.75	94.19	847.73
MAT_5	4498	439.10	112.45	105.73	870.91
GED_1	4498	3.63	1.10	1.00	6.00
GBO_1	4498	1.05	0.27	1.00	3.00
GCA_1	4498	2.51	1.13	1.00	5.00
MTM_1	4498	2.07	0.68	1.00	3.00
MPA_1	4498	1.40	0.68	1.00	3.00
MSV_1	4498	1.16	0.43	1.00	3.00
MSC_1	4498	1.85	0.78	1.00	3.00
GPB_1	4498	1.60	0.66	1.00	3.00

LEVEL-2 DESCRIPTIVE STATISTICS

VARIABLE NAME	N	MEAN	SD	MIN.	MAX.
GSB-1	146	3.33	1.00	1.00	4.00
GSB-2	146	2.07	1.11	1.00	4.00
GAP-1	146	26.92	14.64	5.00	75.00
GAP-2	146	17.35	8.66	0.00	50.00
GAP-3	146	20.06	9.66	0.00	55.00
GAP-4	146	11.51	6.59	0.00	60.00
GAP-5	146	17.74	10.37	0.00	70.00
GAP-6	146	6.43	6.86	0.00	40.00
GAP-7	146	1.20	0.40	1.00	2.00
GAP-8	146	1.21	0.41	1.00	2.00
GAP-9	146	1.21	0.41	1.00	2.00
GAP-10	146	1.42	0.49	1.00	2.00
GAP-11	146	1.40	0.49	1.00	2.00
GAS	146	1.96	0.70	1.00	3.00
SRM	146	2.14	0.56	1.00	3.00
GPPSC	146	2.24	0.62	1.00	3.00
GHW	146	27.26	9.06	15.00	48.00

APPENDIX B

STUDENT QUESTIONAIRE

About You

1

When were you born?

A. Fill in the circle next to the year you were born

Year

1989 - ○
1990 - ○
1991 - ○
1992 - ○
1993 - ○
1994 - ○
1995 - ○
1996 - ○
Other - ○

B. Fill in the circle next to the month you were born

Month

January - ○
February - ○
March - ○
April - ○
May - ○
June - ○
July - ○
August - ○
September - ○
October - ○
November - ○
December - ○

2

Are you a girl or a boy?

*Fill in **one** circle only*

Girl- ①
Boy- ②

3

How often do you speak <language of test> at home?

*Fill in **one** circle only*

Always	①
Almost always	②
Sometimes	③
Never	④

4

About how many books are there in your home? (Do not count magazines, newspapers, or your school books.)

*Fill in **one** circle only*

None or very few (0-10 books)	①
Enough to fill one shelf (11-25 books)	②
Enough to fill one bookcase (26-100 books)	③
Enough to fill two bookcases (101-200 books)	④
Enough to fill three or more bookcases (more than 200 books)	⑤

5

Do you have any of these things at your home?

*Fill in **one** circle for each line*

		Yes	No
a)	Calculator	①	②
b)	Computer (do not include PlayStation®, GameCube®, XBox®, or other TV/video game computers)	①	②
c)	Study desk/table for your use	①	②
d)	Dictionary	①	②
e)	Internet connection	①	②
f)	<country-specific>	①	②
g)	<country-specific>	①	②
h)	<country-specific>	①	②
i)	<country-specific>	①	②

6

A. What is the highest level of education completed by your mother (or stepmother or female guardian)?

*Fill in **one** circle only*

Some <ISCED Level 1 or 2 > or did not go to school ①
<ISCED 2> ②
<ISCED 3> ③
<ISCED 4> ④
<ISCED 5B> ⑤
<ISCED 5A, first degree> ⑥
Beyond <ISCED 5A, first degree> ⑦
I don't know ⑧

B. What is the highest level of education completed by your father (or stepfather or male guardian)?

*Fill in **one** circle only*

Some <ISCED Level 1 or 2 > or did not go to school ①
<ISCED 2> ②
<ISCED 3> ③
<ISCED 4> ④
<ISCED 5B> ⑤
<ISCED 5A, first degree> ⑥
Beyond <ISCED 5A, first degree> ⑦
I don't know ⑧

7

How far in school do you expect to go?

*Fill in **one** circle only*

Finish <ISCED 3> ①
Finish <ISCED 4> ②
Finish <ISCED 5B> ③
Finish <ISCED 5A, first degree> ④
Beyond <ISCED 5A, first degree> ⑤
I don't know ⑥

Mathematics in School

8

How much do you agree with these statements about learning mathematics?

*Fill in **one** circle for each line*

		Agree a lot	Agree a little	Disagree a little	Disagree a lot
a)	I usually do well in mathematics	①	②	③	④
b)	I would like to take more mathematics in school	①	②	③	④
c)	Mathematics is more difficult for me than for many of my classmates	①	②	③	④
d)	I enjoy learning mathematics	①	②	③	④
e)	Mathematics is not one of my strengths	①	②	③	④
f)	I learn things quickly in mathematics	①	②	③	④
g)	Mathematics is boring	①	②	③	④
h)	I like mathematics	①	②	③	④

9

How much do you agree with these statements about mathematics?

*Fill in **one** circle for each line*

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I think learning mathematics will help me in my daily life	①	②	③	④
b) I need mathematics to learn other school subjects	①	②	③	④
c) I need to do well in mathematics to get into the <university> of my choice	①	②	③	④
d) I need to do well in mathematics to get the job I want	①	②	③	④

10

How often do you do these things in your mathematics lessons?

*Fill in **one** circle for each line*

	Every or almost every lesson	About half the lessons	Some lessons	Never
a) We practice adding, subtracting, multiplying, and dividing without using a calculator	①	②	③	④
b) We work on fractions and decimals	①	②	③	④
c) We solve problems about geometric shapes, lines and angles	①	②	③	④
d) We interpret data in tables, charts, or graphs	①	②	③	④
e) We write equations and functions to represent relationships	①	②	③	④
f) We memorize formulas and procedures	①	②	③	④
g) We explain our answers	①	②	③	④
h) We relate what we are learning in mathematics to our daily lives	①	②	③	④
i) We decide on our own procedures for solving complex problems	①	②	③	④
j) We review our homework	①	②	③	④
k) We listen to the teacher give a lecture-style presentation	①	②	③	④
l) We work problems on our own	①	②	③	④
m) We work together in small groups	①	②	③	④
n) We begin our homework in class	①	②	③	④
o) We have a quiz or test	①	②	③	④
p) We use calculators	①	②	③	④
q) We use computers	①	②	③	④

Science in School

11

How much do you agree with these statements about learning science?

*Fill in **one** circle for each line*

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I usually do well in science	①	②	③	④
b) I would like to take more science in school	①	②	③	④
c) Science is more difficult for me than for many of my classmates	①	②	③	④
d) I enjoy learning science	①	②	③	④
e) Science is not one of my strengths	①	②	③	④
f) I learn things quickly in science	①	②	③	④
g) Science is boring	①	②	③	④
h) I like science	①	②	③	④

12

How much do you agree with these statements about science?

*Fill in **one** circle for each line*

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I think learning science will help me in my daily life	①	②	③	④
b) I need science to learn other school subjects	①	②	③	④
c) I need to do well in science to get into the <university> of my choice	①	②	③	④
d) I need to do well in science to get the job I want	①	②	③	④

13

How often do you do these things in your science lessons?

*Fill in **one** circle for each line*

		Every or almost every lesson	About half the lessons	Some lessons	Never
a)	We make observations and describe what we see	①	②	③	④
b)	We watch the teacher demonstrate an experiment or investigation	①	②	③	④
c)	We design or plan an experiment or investigation	①	②	③	④
d)	We conduct an experiment or investigation	①	②	③	④
e)	We work in small groups on an experiment or investigation	①	②	③	④
f)	We read our science textbooks and other resource materials	①	②	③	④
g)	We memorize science facts and principles	①	②	③	④
h)	We use scientific formulas and laws to solve problems	①	②	③	④
i)	We give explanations about what we are studying	①	②	③	④
j)	We relate what we are learning in science to our daily lives	①	②	③	④
k)	We review our homework	①	②	③	④
l)	We listen to the teacher give a lecture-style presentation	①	②	③	④
m)	We work problems on our own	①	②	③	④
n)	We begin our homework in class	①	②	③	④
o)	We have a quiz or test	①	②	③	④
p)	We use computers	①	②	③	④

Computers

14

A. **Do you ever use a computer? (Do not include PlayStation®, GameCube®, XBox®, or other TV/video game computers.)**

	Yes	No
Fill in ***one*** circle only	①	②

*If **No**, please go to question* **15**

B. **Where do you use a computer?**

*Fill in **one** circle for each line*

	Yes	No
a) At home	①	②
b) At school	①	②
c) Elsewhere (e.g., public library, friend's home, Internet café)	①	②

C. **How often do you use a computer for your schoolwork (in and out of school)?**

*Fill in **one** circle for each line*

	Every day	At least once a week	Once or twice a month	A few times a year	Never
a) In mathematics	①	②	③	④	⑤
b) In science	①	②	③	④	⑤

Your School

15

How much do you agree with these statements about your school?

*Fill in **one** circle for each line*

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
a) I like being in school	①	②	③	④
b) I think that students in my school try to do their best	①	②	③	④
c) I think that teachers in my school want students to do their best	①	②	③	④

16

<u>In school</u>, did any of these things happen during the <u>last month</u>?

*Fill in **one** circle for each line*

	Yes	No
a) Something of mine was stolen	①	②
b) I was hit or hurt by other student(s) (e.g., shoving, hitting, kicking)	①	②
c) I was made to do things I didn't want to do by other students	①	②
d) I was made fun of or called names	①	②
e) I was left out of activities by other students	①	②

Things You Do Outside of School

17

On a normal school day, how much time do you spend before or after school doing each of these things?

*Fill in **one** circle for each line*

	No time	Less than 1 hour	1-2 hours	More than 2 but less than 4 hours	4 or more hours
a) I watch television and videos	①	②	③	④	⑤
b) I play computer games	①	②	③	④	⑤
c) I play or talk with friends	①	②	③	④	⑤
d) I do jobs at home	①	②	③	④	⑤
e) I work at a paid job	①	②	③	④	⑤
f) I play sports	①	②	③	④	⑤
g) I read a book for enjoyment	①	②	③	④	⑤
h) I use the Internet	①	②	③	④	⑤
i) I do homework	①	②	③	④	⑤

Homework

18

A. How often does your teacher give you homework in mathematics?

*Fill in **one** circle only*

Every day - ①
3 or 4 times a week - - - - - - - - - - - - - - - - - - - ②
1 or 2 times a week - - - - - - - - - - - - - - - - - - - ③
Less than once a week - - - - - - - - - - - - - - - - ④
Never - ⑤

*If **Never**, please go to question* **19** ➡

B. When your teacher gives you mathematics homework, about how many minutes do you usually spend on your homework?

*Fill in **one** circle only*

Zero minutes - ①
1 - 15 minutes - ②
16–30 minutes - ③
31–60 minutes - ④
61–90 minutes - ⑤
More than 90 minutes - - - - - - - - - - - - - - - - ⑥

19

A. How often does your teacher give you homework in science?

*Fill in **one** circle only*

Every day ------------------------ ①
3 or 4 times a week----------------- ②
1 or 2 times a week----------------- ③
Less than once a week --------------- ④
Never ---------------------------- ⑤

*If **Never**, please go to question **20***

B. When your teacher gives you science homework, about how many minutes do you usually spend on your homework?

*Fill in **one** circle only*

Zero minutes --------------------- ①
1 - 15 minutes -------------------- ②
16–30 minutes -------------------- ③
31–60 minutes -------------------- ④
61–90 minutes -------------------- ⑤
More than 90 minutes --------------- ⑥

More About You

20

A. Was your mother (or stepmother or female guardian) born in <country>?

Yes No

Fill in ***one*** circle only ----------------- ① ----- ②

B. Was your father (or stepfather or male guardian) born in <country>?

Yes No

Fill in ***one*** circle only ----------------- ① ----- ②

21

A. Were you born in <country>?

Yes No

Fill in ***one*** circle only ----------------- ① ----- ②

*If **Yes**, you have completed the questionnaire*

B. If you were not born in <country>, how old were you when you came to <country>?

*Fill in **one** circle only*

Older than 10 years old -------------- ①
5 to 10 years old ------------------- ②
Younger than 5 years old ------------- ③

APPENDIX C

SCHOOL QUESTIONAIRE

School Characteristics

1

A. What is the total school enrollment (number of students) in all grades?

*Number of students:*____________

B. What is the enrollment in the <eighth-grade>?

*Number of students:*____________

2

How many people live in the city, town, or area where your school is located?

*Fill in **one** circle only*

- More than 500,000 people ○
- 100,001 to 500,000 people ○
- 50,001 to 100,000 people ○
- 15,001 to 50,000 people ○
- 3,001 to 15,000 people ○
- 3,000 people or fewer ○

3

Approximately what percentage of students in your school have the following backgrounds?

*Fill in **one** circle for each row*

	0 to 10%	11 to 25%	26 to 50%	More than 50%
a) Come from economically disadvantaged homes	○	○	○	○
b) Come from economically affluent homes	○	○	○	○

4

Approximately what percentage of students in your school have <language of test> as their native language?

*Fill in **one** circle only*

- More than 90% ○
- 76 to 90% ○
- 50 to 75% ○
- Less than 50% ○

5

For the <eighth-grade> students in your school:

A. How many days per year is your school open for instruction?

____________ *days*
(write in number)

B. What is the total instructional time, excluding breaks, in a typical day?

____________ *hours and* ____________ *minutes*
(write in the number of hours and minutes)

C. In one calendar week, how many days is the school open for instruction?

*Fill in **one** circle only*

- 6 days ○
- 5 1/2 days ○
- 5 days ○
- 4 1/2 days ○
- 4 days ○
- Other ○

Please specify ____________

Your Role as Principal

6

By the end of this school year, approximately what percentage of time in your role as principal will you have spent on these activities?

Write in the percent
The total should add to 100%

a) Administrative duties (e.g., hiring, budgeting, scheduling, meetings) ________%

b) Instructional leadership (e.g., developing curriculum and pedagogy) ________%

c) Supervising and evaluating teachers and other staff ________%

d) Teaching ________%

e) Public relations and fundraising ________%

f) Other ________%

Total 100%

Parental Involvement

7

Does your school ask parents to do the following?

*Fill in **one** circle for each row*

	Yes	No
a) Attend special events (e.g., science fair, concert, sporting events)	○	○
b) Raise funds for the school	○	○
c) Volunteer for school projects, programs, and trips	○	○
d) Ensure that their child completes his/her homework	○	○
e) Serve on school committees (e.g., select school personnel, review school finances)	○	○

School Climate for Learning

8 How would you characterize each of the following within your school?

*Fill in **one** circle for each row*

	Very high	High	Medium	Low	Very low
a) Teachers' job satisfaction	○	○	○	○	○
b) Teachers' understanding of the school's curricular goals	○	○	○	○	○
c) Teachers' degree of success in implementing the school's curriculum	○	○	○	○	○
d) Teachers' expectations for student achievement	○	○	○	○	○
e) Parental support for student achievement	○	○	○	○	○
f) Parental involvement in school activities	○	○	○	○	○
g) Students' regard for school property	○	○	○	○	○
h) Students' desire to do well in school	○	○	○	○	○

<Eighth-grade> Instruction in Mathematics and Science

9 Are <eighth-grade> students in your school grouped by ability for their mathematics classes?

	Yes	No
*Fill in **one** circle only*	○	○

10 Does your school do any of the following for students in the <eighth-grade>?

*Fill in **one** circle for each row*

	Yes	No
a) Offer enrichment mathematics	○	○
b) Offer remedial mathematics	○	○

11 Are <eighth-grade> students in your school grouped by ability for their science classes?

	Yes	No
*Fill in **one** circle only*	○	○

12 Does your school do any of the following for students in the <eighth-grade>?

*Fill in **one** circle for each row*

	Yes	No
a) Offer enrichment science	○	○
b) Offer remedial science	○	○

<Eighth-grade> Teachers in Your School

13

In the past two years, what percentage of your <eighth-grade> teachers have been involved in professional development opportunities for mathematics and science targeted at the following?

*Fill in **one** circle for each row*

	None	25% or fewer	26 – 50%	51 – 75%	76 – 100%
a) Supporting the implementation of the national or regional curriculum	○	○	○	○	○
b) Designing or supporting the school's own improvement goals	○	○	○	○	○
c) Improving content knowledge	○	○	○	○	○
d) Improving teaching skills	○	○	○	○	○
e) Using information and communication technology for educational purposes	○	○	○	○	○

14

In your school, are any of the following used to evaluate the practice of <eighth-grade> mathematics teachers?

*Fill in **one** circle for each row*

	Yes	No
a) Observations by the principal or senior staff	○	○
b) Observations by inspectors or other persons external to the school	○	○
c) Student achievement	○	○
d) Teacher peer review	○	○

15

In your school, are any of the following used to evaluate the practice of <eighth-grade> science teachers?

*Fill in **one** circle for each row*

	Yes	No
a) Observations by the principal or senior staff	○	○
b) Observations by inspectors or other persons external to the school	○	○
c) Student achievement	○	○
d) Teacher peer review	○	○

16

How difficult was it to fill <eighth-grade> teaching vacancies for this school year for the following subjects?

*Fill in **one** circle for each row*

	Were no vacancies in this subject	Easy to fill vacancies	Somewhat difficult	Very difficult
a) Mathematics	○	○	○	○
b) Science	○	○	○	○
c) Computer science / information technology	○	○	○	○

17

Does your school currently use any incentives (e.g., pay, housing, signing bonus, smaller classes) to recruit or retain <eighth-grade> teachers in the following fields?

*Fill in **one** circle for each row*

	Yes	No
a) Mathematics	○	○
b) Science	○	○
c) Other	○	○

Student Behavior

18

How often does each of the following problem behaviors occur among <eighth-grade> students in your school?

If the behavior occurs, how severe a problem does it present?

A. Frequency in your school — *Fill in **one** circle for each row in this section*

B. Severity of problem in your school — *Fill in **one** circle for each row in this section*

	Never	Rarely	Monthly	Weekly	Daily	Not a problem	Minor problem	Serious problem
a) Arriving late at school	○	○	○	○	○	○	○	○
b) Absenteeism (i.e., unjustified absences)	○	○	○	○	○	○	○	○
c) Skipping class <hours/periods>	○	○	○	○	○	○	○	○
d) Violating dress code	○	○	○	○	○	○	○	○
e) Classroom disturbance	○	○	○	○	○	○	○	○
f) Cheating	○	○	○	○	○	○	○	○
g) Profanity	○	○	○	○	○	○	○	○
h) Vandalism	○	○	○	○	○	○	○	○
i) Theft	○	○	○	○	○	○	○	○
j) Intimidation or verbal abuse of other students	○	○	○	○	○	○	○	○
k) Physical injury to other students	○	○	○	○	○	○	○	○
l) Intimidation or verbal abuse of teachers or staff	○	○	○	○	○	○	○	○
m) Physical injury to teachers or staff	○	○	○	○	○	○	○	○

Resources and Technology

19

Is your school's capacity to provide instruction affected by a shortage or inadequacy of any of the following?

*Fill in **one** circle for each row*

		None	A little	Some	A lot
a)	Instructional materials (e.g., textbook)	○	○	○	○
b)	Budget for supplies (e.g., paper, pencils)	○	○	○	○
c)	School buildings and grounds	○	○	○	○
d)	Heating/cooling and lighting systems	○	○	○	○
e)	Instructional space (e.g., classrooms)	○	○	○	○
f)	Special equipment for handicapped students	○	○	○	○
g)	Computers for mathematics instruction	○	○	○	○
h)	Computer software for mathematics instruction	○	○	○	○
i)	Calculators for mathematics instruction	○	○	○	○
j)	Library materials relevant to mathematics instruction	○	○	○	○
k)	Audio-visual resources for mathematics instruction	○	○	○	○

*Fill in **one** circle for each row*

		None	A little	Some	A lot
l)	Science laboratory equipment and materials	○	○	○	○
m)	Computers for science instruction	○	○	○	○
n)	Computer software for science instruction	○	○	○	○
o)	Calculators for science instruction	○	○	○	○
p)	Library materials relevant to science instruction	○	○	○	○
q)	Audio-visual resources for science instruction	○	○	○	○
r)	Teachers	○	○	○	○
s)	Computer support staff	○	○	○	○

20

A. Does your school have a science laboratory?

Yes / No

*Fill in **one** circle only* ○ ○

B. Do teachers usually have assistance available when students are conducting science experiments?

Yes / No

*Fill in **one** circle only* ○ ○

21

A. What is the total number of computers in your school that can be used for educational purposes by <eighth-grade> students?

Number of computers: ______

*If **None**, please go to question* **22**

B. How many of these computers have access to the Internet (e-mail or World Wide Web) for educational purposes?

*Fill in **one** circle only*

- All ○
- Most ○
- Some ○
- None ○

22

Is anyone available to help your teachers use information and communication technology for teaching and learning?

Yes / No

*Fill in **one** circle only* ○ ○

APPENDIX D

TIMSS 2007 TURKEY AND INTERNATIONAL AVERAGE OF INDEXES

All of these tables and content of tables were taken from TIMSS International Mathematics Report.

Highest Level of Education of Either Parent						
	University Degree		**Completed Post-secondary Education but Not University**		**Completed Upper-secondary School**	
	Percent of Students	**Average Achievement**	**Percent of Students**	**Average Achievement**	**Percent of Students**	**Average Achievement**
Turkey	7 (0.8)	558 (8.7)	3 (0.3)	497 (8.8)	20 (1.2)	470 (5.2)
International Average	24 (0.2)	485 (0.9)	14 (0.1)	467 (1.0)	25 (0.1)	444 (0.9)

Highest Level of Education of Either Parent						
	Completed Lower-secondary School		Less than Lower-secondary School		Do Not Know	
	Percent of Students	**Average Achievement**	**Percent of Students**	**Average Achievement**	**Percent of Students**	**Average Achievement**
Turkey	52 (1.3)	412 (4.8)	16 (1.0)	389 (4.7)	1 (0.2)	~ ~
International Average	15 (0.1)	418 (1.0)	9 (0.1)	396 (1.4)	13 (0.1)	431 (1.1)

Students Speak the Language of the Test at Home with Trends						
	Always or Almost Always		**Sometimes**		**Never**	
	2007 Percent of Students	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**
Turkey	89 (1.2)	440 (5.0)	10 (1.2)	370 (5.5)	1 (0.2)	--
International Average	78 (0.2)	454 (0.6)	17 (0.1)	427 (1.2)	5 (0.1)	394 (1.9)

Students' Parents Born in the Country with Trends						
	Both Parents Born in Country		Only One Parent Born in Country		Neither Parent Born in Country	
	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement
Turkey	97 (0.3)	434 (4.8)	2 (0.3)		1 (0.2)	
International Average	85 (0.1)	454 (0.5)	9 (0.1)	439 (1.3)	7 (0.1)	430 (1.5)

Computer and Internet Connection in the Home								
	Have Computer		Do Not Have Computer		Have Internet Connection		Do Not Have Internet Connection	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Turkey	43 (1.6)	467 (5.6)	57 (1.6)	408 (4.5)	20 (1.2)	491 (7.3)	80 (1.2)	418 (4.2)
International Average	70 (0.2)	462 (0.7)	30 (0.2)	409 (1.1)	50 (0.2)	466 (0.9)	50 (0.2)	429 (0.9)

Computer and Internet Connection in the Home								
	Have Computer		**Do Not Have Computer**		**Have Internet Connection**		**Do Not Have Internet Connection**	
	Percent of Students	**Average Achievement**	**Percent of Students**	**Average Achievement**	**Percent of Students**	**Average Achievement**	**Percent of Students**	**Average Achievement**
Turkey	43 (1.6)	467 (5.6)	57 (1.6)	408 (4.5)	20 (1.2)	491 (7.3)	80 (1.2)	418 (4.2)
International Average	70 (0.2)	462 (0.7)	30 (0.2)	409 (1.1)	50 (0.2)	466 (0.9)	50 (0.2)	429 (0.9)

Computer Use with Trends						
	Use Computer Both at Home and at School		Use Computer at Home but Not at School		Use Computer at School but Not at Home	
	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement
Turkey	26 (1.3)	486 (6.6)	12 (1.0)	449 (8.9)	46 (1.9)	414 (4.5)
International Average	42 (0.2)	470 (0.8)	25 (0.2)	453 (0.8)	16 (0.2)	409 (1.1)

Books in the Home with Trends						
	More than 200 Books		101–200 Books		26–100 Books	
	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement
Turkey	5 (0.5)	494 (10.8)	9 (0.6)	497 (7.9)	23 (0.9)	467 (5.4)
International Average	12 (0.1)	486 (1.0)	12 (0.1)	481 (0.9)	27 (0.1)	464 (0.6)

Books in the Home with Trends (continued)						
	11–25 Books			0–10 Books		
	2007 Percent of Students	Average Achievement	Difference in Percent from 2003	2007 Percent of Students	Average Achievement	Difference in Percent from 2003
Turkey	37 (1.0)	427 (4.9)		26 (1.5)	378 (4.1)	
International Average	29 (0.1)	436 (0.6)		20 (0.2)	413 (0.8)	

Computer Use with Trends (Continued)						
	2007 Percent of Students	Average Achievement	Difference in Percent from 2003	2007 Percent of Students	Average Achievement	Difference in Percent from 2003
Turkey	13 (1.2)	401 (8.5)		4 (0.7)	366 (7.9)	
International Average	6 (0.1)	409 (1.4)		10 (0.1)	399 (1.2)	

Index of Time Students Spend Doing Mathematics Homework (TMH) in a Normal School Week						
	High TMH		Medium TMH		Low TMH	
	Percent of Students	Average Achievement	Percent of Students	Average Achievement	Percent of Students	Average Achievement
Turkey	22 (1.1)	428 (5.8)	49 (1.0)	433 (5.0)	29 (1.2)	443 (5.9)
International Average	27 (0.2)	458 (0.9)	53 (0.2)	457 (0.7)	20 (0.2)	441, (1.1)

Index of Students' Positive Affect Toward Mathematics (PATM) with Trends						
	High PATM		Medium PATM		Low PATM	
	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement
Turkey	71 (1.2)	450 (5.1)	17 (0.8)	399 (6.3)	11 (0.8)	386 (5.8)
International Average	54 (0.2)	471 (0.6)	21 (0.1)	441 (0.7)	26 (0.1)	428 (0.7)

Index of Students' Valuing Mathematics (SVM) with Trends						
	High SVM		**Medium SVM**		**Low SVM**	
	2007 Percent of Students	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**
Turkey	87 (0.6)	438 (4.8)	10 (0.5)	407 (6.5)	3 (0.3)	361 (11.3)
International Average	78 (0.1)	458 (0.5)	17 (0.1)	438 (0.9)	5 (0.1)	435 (1.3)

Index of Students' Self–Confidence in Learning Mathematics (SCM)with Trends						
	High SCM		**Medium SCM**		**Low SCM**	
	2007 Percent of Students	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**
Turkey	39 (1.1)	494 (6.1)	36 (0.8)	403 (4.7)	24 (1.0)	384 (4.3)
International Average	43 (0.2)	492 (0.6)	37 (0.1)	433 (0.6)	20 (0.1)	412 (0.7)

Principals' Reports on the Percentages of Students in Their Schools Economically Disadvantaged Homes with Trend								
	Schools with Few (0–10%) Economically Disadvantaged Students		**Schools with 11–25% Economically Disadvantaged Students**		**Schools with 26–50% Economically Disadvantaged Students**		**Schools with More than 50% Economically Disadvantaged Students**	
	2007 Percent of Students	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**
Turkey	6 (1.9)	523 (28.0)	10 (2.5)	506 (15.5)	18 (3.4)	449 (13.5)	66 (3.9)	406 (4.8)
International Average	22 (0.4)	476 (1.8)	24 (0.5)	459 (1.4)	21 (0.5)	445 (1.3)	33 (0.5)	427 (1.4)

Index of Good Attendance at School (GAS)						
	High GAS		**Medium GAS**		**Low GAS**	
	2007 Percent of Students	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**	**2007 Percent of Students**	**Average Achievement**
Turkey	25 (3.8)	447 11.3)	53 (5.1)	435 (7.8)	22 (3.5)	408 (11.6)
International Average	21 (0.4)	464 (1.7)	58 (0.6)	450 (0.8)	20 (0.5)	436 (1.6)

Principals' Time Spent on Various School–related Activities with Trends			
	Administrative Duties (e.g., Hiring, Budgeting, Scheduling, Meetings)	**Instructional Leadership (e.g., Developing Curriculum and Pedagogy)**	**Supervising and Evaluating Teachers and Other Staff**
	2007	**2007**	**2007**
Turkey	27 (1.4)	17 (0.8)	20 (0.9)
International Average	30 (0.2)	20 (0.1)	22 (0.1)

Principals’ Time Spent on Various School–related Activities with Trends (continued)			
	Public Relations and Fundraising	Teaching	Other
	2007	2007	2007
Turkey	18 (1.0)	12 (0.6)	7 (0.7)
International Average	11 (0.1)	9 (0.1)	8 (0.1)

Schools' Encouragement of Parental Involvement					
	Percentages of Students Whose Schools Reported That They Ask Parents to Be Involved in the School-related Activity				
	Attend Special Events (e.g., Science Fair, Concert, Sporting Events)	Raise Funds for the School	Volunteer for School Projects, Programs, and Trips	Ensure That Their Child Completes His/Her Homework	Serve on School Committees (e.g., Select School Personnel, Review School Finances)
Turkey	80 (3.2)	81 (3.1)	80 (3.3)	59 (4.5)	62 (4.1)
International Average	90 (0.3)	51 (0.5)	75 (0.5)	92 (0.3)	67 (0.5)

Index of Availability of School Resources for Mathematics Instruction (ASRMI)						
	High ASRMI		Medium ASRMI		Low ASRMI	
	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement
Turkey	8 (2.3)	500 (17.4)	67 (4.2)	435 (6.0)	25 (3.9)	403 (10.3)
International Average	27 (0.5)	464 (1.4)	62 (0.5)	449 (0.9)	10 (0.4)	420 (2.8)

Index of Principals' Perception of School Climate (PPSC) with Trends						
	High PPSC		Medium PPSC		Low PPSC	
	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement	2007 Percent of Students	Average Achievement
Turkey	8 (2.2)	498 (23.8)	55 (4.4)	444 (6.6)	36 (4.3)	398 (7.8)
International Average	16 (0.4)	473 (1.6	68 (0.5)	450 (0.7)	16 (0.4)	428 (1.6)