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Unpacking the inequality among Turkish schools: Findings from PISA 2006

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ABSTRACT

The study investigates the effects of certain school characteristics on students' mathematics performances in Turkey in the PISA 2006 while controlling for family background and demographic characteristics. Three models of Hierarchical Linear Modeling (HLM) are constructed. The results reveal 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. The findings are interpreted to explain why Turkish schools differed greatly in average student performance in PISA 2006 by using the conceptual efforts on school quality factors and family background characteristics.

1. Introduction

Turkey has been undergoing a reform in education due to rapid changes in the structure of its economy and the demographics of its young people. Two overarching aims of the reform process are to raise the *quality* of educational outputs and to improve *equality* and *access* to education by different sectors of the society (Akşit, 2007). There is a need for empirical studies to identify the areas of concern in the system and decide on the direction of changes in the reform process. Two studies that can be useful in this regard are the *Student Assessment Program* – SAP (MONE, 2007a) and *Program for International Student Achievement* – PISA (OECD, 2007a). These two studies periodically take the national pulse in student achievement and collect information about students' school contexts and family backgrounds.

PISA is a program sponsored by the OECD. It is a system of international assessments that focus on the capabilities of 15-year-olds in reading, mathematics, and science literacy. PISA 2000 was the first cycle of the program, which is conducted every three years, with a primary focus on one area for each cycle. PISA 2000 focused on reading literacy; mathematics literacy was the focus in 2003, and science literacy in 2006. In addition to assessment data, PISA provides background information on school contexts and student demographics to benchmark performance and inform policy. Thirty OECD and 27 partner countries participated in 2006 making it the most comprehensive international study thus far. About one-third of the world's population and 90% of the world's economy are represented in the study. Turkey participated in 2003, 2006 and 2009 PISA programs. Data from 2003 and 2006 are currently available.

The results of the 2003 and 2006 studies provide a measure of Turkey's international standing and a window into important matters of educational policy in Turkey. The picture painted by the performance of Turkish students has been consistent: they displayed a performance approximately three quarters of a standard deviation below that of the international average (about 425 against the international average of 500).

One of the most striking findings of PISA 2003 was that Turkey had the largest variance internationally between schools in student performance. Turkey has both high performing and low performing students with a higher proportion of students in the lower end (OECD, 2007a). Understanding the reasons that led to the disparity between different types of Turkish schools is the motivation behind this study.

PISA collects data about students' performance in mathematics, science and reading as well as students' family background, classroom processes, and school characteristics. It is therefore possible to relate students' background to their performance in mathematics. This paper attempts to identify the factors that explain the variance in mathematics achievement due to differences in *school characteristics and processes* based on the data collected from PISA 2006 while controlling for *family and demographic variables*.

1.1. The impetus for studying school characteristics

In a line of scholarly work named *school effectiveness*, researchers have been interested in explaining young people's success in schools (e.g., Bassani, 2006; Tremblay et al., 2001;

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Willms, 1996). In mid-1960s, James Coleman and his colleagues published the now famous report; *Equality of Educational Opportunity* (Coleman et al., 1966). This was a large-scale study set out to find the causes of variation in academic achievement of students in American schools. They reported that family background and other characteristics that predate entry to school are much more predictive of student achievement than school variables such as school funding or teacher quality. Also, in *Inequality*, another American study, Jencks et al. (1972) concluded that family circumstances and luck were more important than education in affecting how well one does in life. These conclusions undermined the reformist optimism that schools make a difference in students' lives.

There were soon challenges to their conclusions. In 1983, Heyneman and Loxley suggested that findings of Coleman et al. (1966) may not be generalized beyond developed countries. They conducted a study of their own with 29 countries from Africa, Asia, Latin America, and Middle East in addition to the developed countries from Europe and North America to see the effects of family background and school quality on academic achievement and how these factors interact with the level of economic development. They reported that the lower the income of the country, the weaker the effect of family and background variables on academic achievement, and greater the effect of school and teacher quality. Turkey was not included in their study, however for Mexico which has a similar level of per capita income with Turkey, they reported that about 55% of variance in student achievement is attributable to school quality, when the percentage was 35 for the US and even lower for the other developed countries.

Why was there a difference in the level of the effect of school quality on student achievement among developed and developing countries? One possibility was that as wealthier nations have more funds to institutionalize schooling within their societies, there was probably a higher threshold of school quality than it was in poorer nations. In other words there was probably more variation in school quality in poorer nations than there was for wealthier nations. This led to a stronger connection between school quality and academic achievement since for example, lack of physical facilities or textbooks, or qualified teachers, etc. were more likely to be found in poorer countries and hence were more likely to hinder student learning in these countries (Baker et al., 2002). Another factor could be that education as a commodity was both scarce and in high demand in low-income countries. In richer countries, there was a plethora of educational avenues; university for elderly people, allowed leaves from employment for education, and educational degrees by television. So the educational needs of the population were met at a level of higher saturation. Scarcity of education in low-income countries might have created high competition for the few educational opportunities, and a higher value for doing well in schools. Those who were lucky to be able to enroll into few good educational facilities value the opportunity highly and hence made large efforts to attain achievement. If they did not, they knew they would be replaced quickly by others who would. This in turn could have led to a higher level of student achievement in better schools than it was the case in developed nations (Heyneman and Loxley, 1983). These two explanations provide perspectives into the complex dynamics of the ways school resource quality (or school social capital, as we will refer to it below) is mitigated by the level of economic development to affect student achievement in nations with different levels of development.

More recently, using the same methodology as Heyneman and Loxley, Baker et al. (2002) analyzed data from the Third International Mathematics and Science Study (TIMSS) and reported a weakening of the *Heyneman–Loxley effect* in 1990s, that is poor nations having a larger effect of school quality and relatively smaller effects of family background on student achievement. They called this phenomenon as the "spreading of the *Coleman effect*," (p. 312) and explained it by the massive expansion of schooling in poor nations and improvements in school quality around the World from 1970s to 1990s. Coleman et al., Heyneman and Loxley, as well as Baker et al. provide useful perspectives to understand how family background and SES, school resource quality and the level of national income work together to explain the current levels of student achievement in Turkey.

In one of the few studies that focused on family and school effects in Turkey, Günçer and Köse (1993) sought to explain variance in students' performance in the *Student Selection Exam*, a centralized examination conducted annually to select and place students in the tertiary education. They report that family background and SES explained a relatively large part of the variance (40%) of student performance while school quality explained a small portion of the variance (2%). The small school resource quality effect they found may however be attributed to the methodological limitations of their study: their sampling included schools only from Ankara, the capital of Turkey, which might have had relatively similar (and better) school characteristics compared to the rest of the country. Further they defined school quality as perceived by the teachers who work there, rather than using objective measures. On the other hand, in a study investigating student achievement across school types and geographical region using PISA 2003 data and data from 1999 to 2002 *Student Selection Examination*, Berberoglu and Kalender (2005) report that regional differences for student achievement were relatively small compared to the large achievement gaps between school types.

2. Social capital theory

We ground this study in *social capital theory* to understand how schools affect student learning. Social capital, broadly conceived, concerns institutions, relationships, attitudes, and values that govern interactions among people and affect economic, social, and individual development (Grootaert and Van Bastelaer, 2002). It has been used successfully in understanding social development including schooling and school outcomes (e.g., Bassani, 2006; Goddard, 2003; Ostrom, 2000; Parcel and Dufur, 2001). The social capital framework fits into the tradition of capital-based theories. Physical capital indicates the transformation of raw material into something profitable. Similarly, new types of capital such as financial capital (e.g., income), human capital (e.g., education, socio-economic status), and cultural capital (e.g., cultural knowledge and experiences) as well as social capital are used to explain varying levels of economic development, individual well-being and other outcomes in sociology, public health and education. Intellectually, the theory grew out of the work of French sociologist Pierre Bourdieu who first coined the term cultural capital in the 1980s (Bourdieu, 1986). It was first systematically developed into a conceptual framework as we know it today by James Coleman (1987, 1988).

Social capital can be analyzed based on the forms in which it is observed: *structural social capital* and *functional social capital. Structural social capital* signifies tangible and externally observable forms of social resources such as associations, networks, institutions, members within families, or the type of schools (private or public) and the explicit rules that govern these structures. *Functional social capital*, on the other hand, indicates predominant forms of attitudes and norms of behavior and shared values within a social unit (Grootaert and Van Bastelaer, 2002). Within schools, indicators of functional social capital would be the shared norms and values of teachers, administrators and students, the quality and quantity of interactions between them, and their attitudes toward academic and curricular goals (Grootaert and Van Bastelaer, 2002).

According to Coleman (1987), social capital is the root of understanding the factors explaining academic performance. In particular, social capital at the family level and school social capital are linked to individual student academic achievement. The social capital framework postulates that the more capital in the student's family and the more capital in the school that he/she attends, the higher his/her academic achievement will be. Also, family and school social capital may positively interact to boost the effect on achievement. Alternatively, if one is deficient, it may lower the achievement. When there is deficiency in both of them, this is called the *double jeopardy* effect on achievement. There are a host of variables that fall into the general category of family and school social capital. There are also other types of resources related to family and school such as physical capital, and human capital. These variables and their connection to student achievement in mathematics have been studied in Western cultures and cross-culturally (e.g., Bassani, 2005).

2.1. School variables

Structural social capital in school is typically examined in relation to tangible and objective social factors such as class size, the size of the community and the developmental level of the region where the school is located, school type (e.g., academic vs. vocational), school ownership (private vs. public). The *functional social capital of schools*, such as the locus of decision-making, and admission policies, is also important to understand the ways a school functions. These factors are examined in relation to student achievement.

Research done in the United States has shown that smaller classes positively influence student achievement in schools (Bali and Alvarez, 2003; Cohen et al., 2003), although some researchers found these to be unrelated (e.g., Schreiber, 2002). Studies that investigated the effect of size of community where the school is located on student achievement have also resulted in contradictory findings (Boyle and Lipman, 1998; Caldas and Bankston, 1999). In Turkey, it would be reasonable to expect that students in schools in bigger communities such as towns and cities, and in better-developed (Western and central) regions would perform higher than students in smaller communities and less-developed regions since they would have access to improved physical and cultural resources.

Schools with more demanding curricula, higher levels of intellectual stimulation and selective admission policies are known to result in higher student learning (Morgan and Sorensen, 1999; Stevenson et al., 1993). There is indeed evidence that there are significant performance differences in PISA 2006 between different school types in Turkey (MONE, 2007b). Also, academically oriented schools in Turkey, such as Anatolian and science high schools, have stronger mathematics and science curricula and expect higher levels of learning from students (OECD, 2007b). Students are accepted to these schools through a selective and competitive national examination, resulting in those with a high aptitude towards mathematics and science being placed in them.

Students in Science High Schools, Anatolian High Schools, and Foreign Language Intensive High Schools have performance levels above OECD average in PISA 2006, while students in general high schools and vocational and technical high schools which house the largest portions of the student populace performed well below the average.

Schools whose teachers and administrators possess local decision-making powers that directly affect student learning in such matters as curriculum enactment and choice of supplies are associated with higher student learning (Woessman, 2001). On the other hand, local control of choosing textbooks, the curriculum or determining the budget seemed to be detrimental to student learning, as these decisions may be made with teachers' and administrators' interests in mind rather than student learning.

2.2. Family variables

Human capital in the family in relation to a child's educational attainment has been investigated by many researchers and was found to positively influence academic success (Coleman, 1987, 1988; Joshi, 1995; O'Brien et al., 1999; Reynolds and Walberg, 1992). Human capital is typically measured by examining a combination of the family's socio-economic status (SES) including parental education, income, and occupational status of one or both parents. Families with higher social status are thought to instill positive values toward education, provide expectations and role models for doing well in school while affording better means and ways of doing so, compared to families with lower social status. These then induce higher academic achievement in children. Because family human capital is such a core factor affecting student achievement, it is often controlled to test the effects of other variables (Willms, 1996).

Another family resource affecting student achievement is physical capital at home. The availability of resources with direct educational use such as own room, desk, books, computer, internet, dictionaries and other reference sources, has particularly been found to influence students' achievement positively (Kalmijn and Kraaykamp, 1996). Although physical capital positively influences educational attainment, the size of the effect was found to be much smaller than that of family human capital (Wilkins and Ma, 2002). In fact, it would be reasonable to assume that the family's physical capital is related to the family's socio-economic status. In this study, because of its correlation with family SES and following OECD (2007a), we utilized the PISA *index of economic, social and cultural status* (ESCS), a composite measure of socio-economic status capturing parental education, occupational status and family physical capital.

3. Method

3.1. Data

The data analyzed in this research were obtained from the PISA 2006 study. PISA required each country to maximize the coverage of PISA's target population within the sampled schools. Thus, PISA data are drawn through a two-tiered stratified sampling process; systematic sampling of the individual schools in which 15-year-old students could be enrolled and then random selection of 35 students from a list of all 15-year-old students in the schools (OECD, 2007a). In sampling, furthermore, the total number of students and their relative weights in the total targeted population were considered while deciding on the number of students for each province. The Turkish data for PISA 2006 were collected from a sample of 4942 fifteen-year-old students (2290 girls and 2652 boys) in 160 schools attending 7th ($n = 23$), 8th ($n = 93$), 9th ($n = 2007$), 10th ($n = 2671$) and 11th ($n = 148$) grade classes across 78 provinces and 7 geographical provinces. The Turkish sample is representative of the 15-year-old students as the index of coverage of the national enrolled-in-schools-population was .98 (out of 1) (OECD, 2007a, p. 350).

3.2. Measures and variables

Based on the theoretical consideration and empirical findings from previous studies explained above, several school level explanatory variables were selected in order to examine their association with students' performance in mathematics. The variables were grouped into five categories which represent functional social capital in schools: (i) school autonomy; (ii) school management and funding; (iii) school resources; (iv) admitting, grouping and selecting; (v) school program type. For each of the five categories, a few related variables were selected from the PISA 2006 database collected from Turkish students. Indices prepared in the PISA 2006 database are preferred over single-item statements from student and school questionnaires because they combine more information and would be more reliable than single items psychometrically (OECD, 2007a).

Several demographic (e.g., gender, geographic region) and socio-economic factors (e.g., individual students' SES, schools' average SES) were used in the analyses to stand for background variables. Based on the literature, such factors are considered as less likely to be affected by schools (e.g., Bassani, 2005, 2006; OECD, 2007a). The PISA *index of economic, social and cultural status* (ESCS) and student gender were the two student level background variables. As described in OECD (2007a, p. 333), socio-economic background of the students was indicated by the ESCS. This variable was constructed to represent broad aspects of students' family and home background as well as the occupational status of the parents. Since socio-economic status is usually considered as being determined by occupational status, education and wealth, ESCS was derived from three PISA indices: the *highest international socioeconomic index of occupational status* (HISCEI) of the father or mother; the *index of highest educational level of parents* (HISCED) converted into years of schooling; and the *index of home possessions* (HOMEPOS).

A Principal Component Analysis was carried out to derive factor scores as the student scores on the index that are standardized so that the OECD mean of the index is 0 and the standard deviation is 1. Ehmke and Siegle (2005) have shown that ESCS is a valid and inclusive index of social background and accounts for significantly more variance in mathematics competency than the following single predictors: socio-economic status (HISEI), parents highest educational attainment expressed in years of education (PARED) and index of home possessions (HOMEPOS). Furthermore, at the school level, four indicators of structural social capital were included in the background variables: (i) school community, (ii) size of school, (iii) school's average ESCS, and (iv) geographical region where the school is located.

The selected background and explanatory variables were re-coded as suggested in OECD (2007a) where necessary to carry out the statistical analysis. Categorical variables were re-coded into a

Table 1
Description of background and explanatory variables with descriptive statistics.

Variable description	Type[a]	Coding	Mean	S.D	Min.	Max.
Student level						
Student's PISA index of economic, social and cultural status	B	1 = OECD S.D.	−1.2	1.1	−4.4	2.10
Student is female	B	1 = yes; 0 = no	0.5	0.5	0	1
School level						
School located in a small town or village (fewer than 15,000 people)	B	1 = yes; 0 = no	0.1	0.3	0	1
School located in a city (with over 100,000 people)	B	1 = yes; 0 = no	0.5	0.5	0	1
School size	B	100 additional students	10.1	7.3	0.5	48.8
School average index of economic, social and cultural status	B	1 = OECD S.D.	−1.3	0.6	−2.8	0.8
School is located in Central Anatolia region	B	1 = yes; 0 = no	0.2	0.4	0	1
School regional location[b]						
Aegean region	B	1 = yes; 0 = no	0.1	0.3	0	1
Mediterranean region	B	1 = yes; 0 = no	0.1	0.4	0	1
Black sea	B	1 = yes; 0 = no	0.1	0.3	0	1
Eastern Anatolia	B	1 = yes; 0 = no	0.1	0.3	0	1
Southeastern Anatolia	B	1 = yes; 0 = no	0.1	0.3	0	1
School autonomy						
School autonomy index in staffing	E	1 = S.D. across Turkey	−0.01	1.0	−0.2	6.1
School autonomy index in budgeting	E	1 = S.D. across Turkey	0.05	1.0	−2.0	0.9
School autonomy index in educational content	E	1 = S.D. across Turkey	0.03	1.0	−1.1	2.5
School management and funding						
School being privately managed	E	1 = private; 0 = public	0.02	0.1	0	1
School with high proportion of school funding from government sources	E	Each additional 10%	55.8	33.3	0	100
School resources						
School average number of students per teacher (student-teacher ratio)	E		19.0	8.3	1.9	48.3
School-level index of teacher shortage	E	1 = OECD S.D.	1.4	1.2	−1.1	3.6
School average number of computers for instruction per student	E		0.05	0.1	0	0.3
School-level index of quality of school educational resources	E	1 = OECD S.D.	−0.82	1.0	−3.4	2.1
School average students' learning time for regular lessons in school	E	1 additional hour per week	10.7	2.6	5	17.1
School average students' learning time for out-of-school lessons	E	1 additional hour per week	5.3	1.5	1.3	8.6
School average students' learning time for self-study or homework	E	1 additional hour per week	6.2	1.4	2.3	10.1
Admitting, grouping and selecting						
School with ability grouping for all subjects within school	E	1 = yes; 0 = no	0.2	0.4	0	1
School with low academic selectivity of school admittance	E	1 = yes; 0 = no	0.3	0.5	0	1
School with high academic selectivity of school admittance	E	1 = yes; 0 = no	0.2	0.4	0	1
School program type[c]						
Primary education	E	1 = yes; 0 = no	0.1	0.2	0	1
Anatolian high school	E	1 = yes; 0 = no	0.1	0.3	0	1
Vocational high schools	E	1 = yes; 0 = no	0.3	0.5	0	1
Anatolian vocational high schools	E	1 = yes; 0 = no	0.04	0.2	0	1
Secondary and vocational high school	E	1 = yes; 0 = no	0.06	0.2	0	1

[a] "B" refers to the background (or control) variable and "E" refers to explanatory variable.
[b] Marmara region was selected as the reference region for dummy coding.
[c] General High School was selected as the reference school program type for dummy coding. Science High School program type was not included in the analysis, as there was only one science high school in the sample.

set of variables. For each category or for combined categories, a dummy variable was created with the value of 1 if the observation belongs to the respective category and 0 otherwise. There were no missing values for any of the variables for all student and school level data. In Table 1, we present the descriptions of background and explanatory variables included in this study along with the descriptive statistics.

3.3. Procedures for data analysis

Generally, regression analysis is used to examine the relationship between a dependent variable (e.g., academic achievement) and one or more independent variables (family socio-economic status or prior academic program followed.) One of the assumptions that traditional regression analysis is based on is the independence of the variables involved. This assumption is violated when for example students come from the same school or the same academic program. Hierarchical linear modeling is a special regression technique that can take into account the hierarchical nature of educational variables (Raudenbush and Bryk, 2002). Considering the fact that the variables chosen may have dependence among themselves, we chose to use hierarchical linear modeling as the main analytic technique in this study.

To investigate the effects of the measures of school social capital on students' academic success while controlling for family physical and human capital, a two-level regression analysis was carried out using Hierarchical Linear Modeling (HLM) (Raudenbush et al., 2008), In the model, students served as level 1, schools as level 2. The model coefficients and statistics were estimated using a full maximum likelihood procedure. Normalized student final weights (W_FSTUWT) were used, so that the sum of the weights was equal to the number of students in the dataset, and each school contributed equally to the analysis. Five plausible values (PV1MATH–PV5MATH) for the students' mathematics performance served as the outcome variable.

In building the multilevel models, a step-by-step approach was adopted as suggested by OECD (2007a). First, a background model for student performance was carried out with only background (or control) variables considered. Then, the impact of selected school-level variables on mathematics performance was analyzed using multilevel models before and after accounting for the background (control) variables.

The former (before accounting for background variables) was referred to as gross effects while the latter was referred to as net effects model (OECD, 2007a, p. 262). As suggested by OECD (2007a) and Raudenbush and Bryk (2002), a two-step procedure was carried in the analysis of the impact of the school-level variables on mathematics performance. In the first step, the effects of the five groups of school-level variables (i.e., school regional location; school autonomy; school management and funding; school resources; admitting, grouping and selecting; school program type (see Table 1) were examined in turn, estimating separate models for each group of variables. In the second step, only the significant predictors from each of the separate models run in the first step were included in the model. Looking into the effects of variables on student achievement in the background, gross and net models gave us the opportunity to find which variables do indeed have a robust effect as seen across the models.

In all of the models, all slopes were fixed and only the intercept was randomized at both levels. Furthermore, all variables including both explanatory and background variables were centered on the grand mean (i.e., a linear transformation of variables subtracting the overall mean of Turkey). Thus, in all models, the intercept was interpreted as the achievement score in mathematics for a student who has the national mean in all variables included in the model. Throughout the multilevel analysis an effect was considered statistically significant if the p-value is below 0.05 at school level.

4. Results

The empty model (or null or unconditional) where no predictors at either level 1 or level 2 included in the model revealed that the variation among schools in their students' mathematical literacy was significantly large: $\chi^2(159) = 6107.31$, $p < .0001$. This suggests that school level variables might account for a big chunk of the differences in students' mathematical performance. In fact, the intra-class correlation was found to be .5485. In other words, in the Turkish PISA 2006 data, about 55% of the variation in the students' mathematics literacy scores is between-schools. The "plausible value range" (Raudenbush and Bryk, 2002, p. 71), indicating how much Turkish mathematics literacy scores vary between schools, is computed from 279 to 552. This shows that school mean achievement is likely to range from 279 to 552 across 95% of the schools in Turkey that serve 15-year-olds. Furthermore, the overall estimate of reliability was found to be $\rho = 0.97$ indicating that the sample means tend to be a reliable indicator of true school means. Furthermore, the intercept in the empty model was computed as 415.69 with S.E. = 7.44 and $p < .0001$.

4.1. The background model

Table 2 presents background model showing the impact of background variables in mathematics performance of Turkish 15-year-old students.

From Table 2, we observe that three of the background variables were significant, they are: student's PISA index of economic, social and cultural status (ESCS), gender, and school average ESCS. The school community, school size (i.e., number of students) and geographical region of Turkey where the school is located were not statistically significant. The percentage of variance explained by the background variables was computed as 1.43 at the student level and 33.47 at the school level. In other words, background variables explain about 33% of the between-school variance and only 1% of the within-school variance. The fact that a large portion of between-school variance is explained by background variables means that Turkish schools are mainly attended by groups of students with similar socio-economic backgrounds.

4.2. The gross model

Table 3 shows the gross multilevel model for mathematics performance of Turkish 15-year-old students in PISA 2006. Only the following three school factors had effects on mathematics performance before accounting for the demographic and socio-economic background factors: school average number of students per teacher (student–teacher ratio), school average for students' learning time for regular lessons in school, school with high academic selectivity of school admittance.

4.3. The net model

Table 4 shows the net multilevel model for mathematics performances of Turkish 15-year-old students in PISA 2006. Only the following two school factors had effects on mathematics performance after accounting for the demographic and socio-economic background factors: school average of students' learning time for regular lessons in school, and school with high academic selectivity of school admittance. Similar to the background model, the student's PISA index of economic, social and cultural status (ESCS), gender, and school average ESCS are found to be significant

Table 2
The background model for mathematics performances of Turkish 15-year-old students in PISA 2006.

	Change in score	S.E.	*p*-Value
Intercept	424.84	4.04	0.000
Background variables			
Student's PISA index of economic, social and cultural status	9.42	1.26	0.000
Student is female	−16.71	2.86	0.000
School located in a small town or village (fewer than 15,000 people)	−13.75	15.3	0.370
School located in a city (with over 100,000 people)	−7.75	8.93	0.387
School size	−0.42	0.72	0.560
School average index of economic, social and cultural status	65.31	4.04	0.000
School is located in Central Anatolia region	1.41	12.63	0.912
School is located in Aegean region	9.22	14.13	0.515
School is located in Mediterranean region	13.36	13.34	0.319
School is located in Black sea region	19.16	14.86	0.200
School is located in Eastern Anatolia region	−17.66	16.34	0.282
School is located in Southeastern Anatolia region	−19.72	24.06	0.414
Variance explained (expressed as % of total variance)			
Student level		1.43	
School level		33.47	
Total		34.9	

background variables having positive effect on student mathematics performance. Furthermore, it was also found that students in schools located in Eastern Anatolia and Southeastern Anatolia regions are mostly likely to score much lower than students in Marmara region.

By comparing Tables 3 and 4 we can make a combined comparison of relationship between school factors and mathematics performance as estimated before and after accounting for socio-economic and background variables at student and school levels. Although the school average number of students per teacher (student–teacher ratio) has an effect on mathematics learning before accounting for the socio-economic and demographic contexts, the effect is no longer statistically significant after accounting for the socio-economic and demographic variables. On the other hand, two school factors listed below have effects on mathematics learning before and after accounting for the socio-economic and demographic contexts:

- School principals' reports regarding high academic selectivity of school admittance. Students in schools in which academic

Table 3
The gross model for mathematics performances of Turkish 15-year-old students in PISA 2006.

	Model 1G first gross combined			Model 2G second gross combined		
	Change in score	S.E.	*p*-Value	Change in score	S.E.	*p*-Value
Intercept	422.31	4.39	0.000	424.29	3.29	0.000
School autonomy						
School autonomy in staffing	−0.53	6.4	0.934			
School autonomy in budgeting	−11.6	6.71	0.095			
School autonomy in educational content	5.94	6.29	0.347			
School management and funding						
School being privately managed	28.51	26.79	0.289			
School with high proportion of school funding from government sources	0.11	0.25	0.654			
School resources						
School average number of students per teacher (student-teacher ratio)	−2.06	0.62	0.001	−1.41	0.5	0.006
School-level index of teacher shortage	1.21	3.5	0.72			
School average number of computers for instruction per student	−31.38	75.94	0.68			
School-level index of quality of school educational resources	4.22	4.95	0.395			
School average students' learning time for regular lessons in school	25.46	2.76	0.000	17.8	3.06	0.000
School average students' learning time for out-of-school lessons	−2.29	6.61	0.73			
School average students' learning time for self-study or homework	−9.4	6.66	0.16			
Admitting, grouping and selecting						
School with ability grouping for all subjects within school	−10.79	15.73	0.494			
School with low academic selectivity of school admittance	−4.96	14.92	0.74			
School with high academic selectivity of school admittance	102.23	17.76	0.000	37.79	10.94	0.001
School program type (General High School is the reference school)						
Primary education	−70.86	28.3	0.014	−32.31	24.24	0.185
Anatolian high school	93.39	16.50	0.000	18.7	14.35	0.195
Vocational high schools	−45.51	7.91	0.000	4.99	10.99	0.65
Anatolian vocational high schools	−9.36	46.71	0.842			
Secondary and vocational high school	−51.99	10.94	0.000	−10.49	17.22	0.907
Variance explained (expressed as % of total variance)						
Student-level		−0.09			−0.16	
School-level		40.97			40.55	
Total		40.88			40.38	

Table 4
The net model for mathematics performances of Turkish 15-year-old students in PISA 2006.

	Model 1N first net combined			Model 2N second net combined		
	Change in score	S.E.	*p*-Value	Change in score	S.E.	*p*-Value
Intercept	423.67	2.61	0.000	424.01	2.99	0.000
School autonomy						
School autonomy in staffing	−6.14	3.64	0.093			
School autonomy in budgeting	0.3	4.15	0.943			
School autonomy in educational content	0.96	4.24	0.822			
School management and funding						
School being privately managed	−48.19	22.53	0.034	−28.26	20.38	0.168
School with high proportion of school funding from government sources	−0.03	0.14	0.809			
School resources						
School average number of students per teacher (student-teacher ratio)	−0.81	0.48	0.09			
School-level index of teacher shortage	4.45	2.67	0.097			
School average number of computers for instruction per student	46.11	87.72	0.599			
School-level index of quality of school educational resources	0.6	4.55	0.895			
School average students' learning time for regular lessons in school	17.82	2.52	0.000	12.32	2.6	0.000
School average students' learning time for out-of-school lessons	−2.31	4.32	0.595			
School average students' learning time for self-study or homework	−3.77	5.37	0.484			
Admitting, grouping and selecting						
School with ability grouping for all subjects within school	6.52	10.16	0.522			
School with low academic selectivity of school admittance	18.03	9.62	0.062			
School with high academic selectivity of school admittance	57.13	13.5	0.000	33.35	10.96	0.003
School program type (general high school is the reference school)						
Primary education	17.21	19.23	0.373			
Anatolian high school	54.1	14.14	0.000	13.00	13.44	0.335
Vocational high schools	−33.87	10.48	0.002	−8.83	11.29	0.435
Anatolian vocational high schools	−4.82	35.39	0.892			
Secondary and vocational high school	17.39	17.23	0.315			
Background variables						
Student's PISA index of economic, social and cultural status (ESCS)	9.42	1.26	0.000	9.42	1.26	0.000
Student is female	−16.37	2.82	0.000	−16.43	2.83	0.000
School located in a small town or village (fewer than 15,000 people)	−7.71	12.88	0.55	−7.93	13.83	0.567
School located in a city (with over 100,000 people)	3.3	6.74	0.625	7.11	6.61	0.285
School size	0.07	0.6	0.913	−0.53	0.56	0.346
School average index of economic, social and cultural status	27.01	8.22	0.002	24.45	9.88	0.015
School is located in central Anatolia	−0.96	10.02	0.925	−1.6	9.55	0.868
Aegean region	2.52	8.98	0.779	1.08	9.68	0.912
Mediterranean region	−18.35	12.35	0.139	−17.64	11.73	0.135
Black sea region	−1.95	11.43	0.865	−0.18	10.01	0.985
Eastern Anatolia	−41.97	16.14	0.011	−47.74	17.01	0.006
Southeastern Anatolia	−37.64	14.76	0.012	−43.74	19.23	0.024
Variance explained (expressed as % of total variance)						
Student-level		1.39			1.36	
School-level		45.31			45	
Total		46.69			46.36	

records or feeder school recommendations were a prerequisite for school admittance score 33.35 points higher than students in schools applying a moderate selective admittance policy, all other things being equal.

- School principals' reports regarding the school average time students have in learning the three disciplines: science, mathematics and language at school. Students in schools with one additional average hour per week score 12.32 points higher, all other things being equal.

The net combined model, which includes demographic and socio-economic background factors, as well as the school factors in the net model, explains 46.36% of the total mathematics performance variance (see Fig. 1). Forty-five percent lies between schools (equivalent to over four-fifths of the total variance between-schools) and 1.36% lies between students within-schools. Furthermore, of the 45% of explained between-school variance, 11.53% is explained uniquely by school factors and only 4.45% is explained uniquely by background factors. The remaining 29% is explained jointly by school and background factors.

This picture indicates that about one-fifth of the total between-school mathematics performance variance is exclusively explained by the school factors involved in the net combined multilevel model. Further, the impact of the interaction between school factors and background factors (i.e., mainly socio-economic) on mathematics performance is even bigger, explaining more than half of the total variance among schools.

5. Discussion and conclusions

Our findings in this study and other data reported elsewhere paint a complex picture of the outcomes of education in Turkey. First, Turkey has the most unlike schools internationally in terms of student performance in PISA. Second, Turkey seems to have students grouped by socio-economic status in schools. Third, Turkish students come from the lowest levels of socio-economic background compared to their peers in other countries: about 63% of Turkish students fall within the lowest 15% of the international distribution of ESCS in OECD countries. Performance of Turkish students was estimated to increase the most internationally, if the

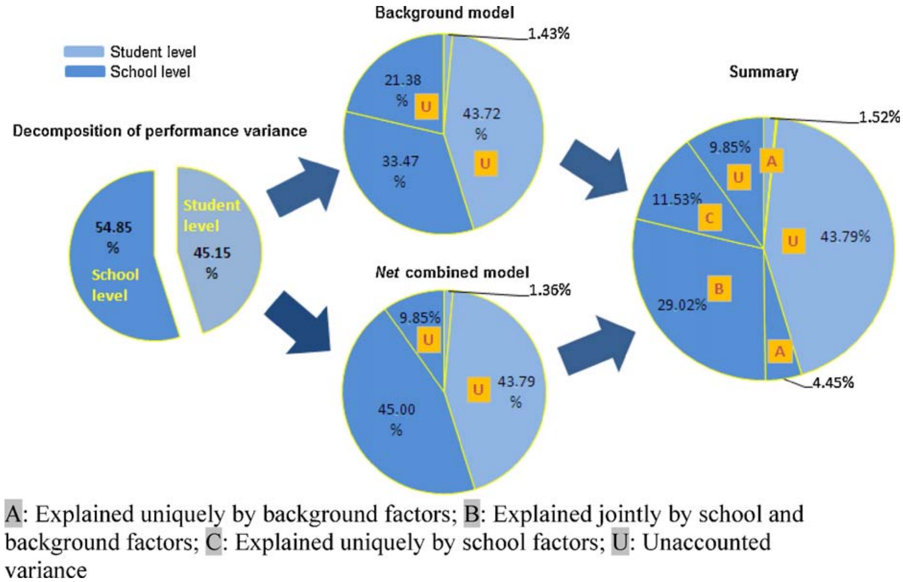

Fig. 1. Variance and explained variance in mathematics performance at student and school levels.

SES levels of Turkish students would equal to the average ESCS level of the OECD countries (OECD, 2007a). This finding points to the relatively high level of effect of students' family SES background has on student achievement in Turkey. It looks like Turkey has one of the largest *school effects* on student achievement, and has quite a high family background SES effect as well. This complex picture requires a careful interpretation of the insights gained from Coleman et al. (1966) and Heyneman and Loxley (1983) in the Turkish context.

Why did Turkish students display such a large family background effect? One explanation is the transformation the country has gone through since 1960s and which accelerated in the last two decades. Turkey has undergone a persistent and an increasing rate of industrialization and economic development. The benefits of industrialization and economic development went mainly to an elite segment of the society which led to a wider socio-economic stratification (Günçer and Köse, 1993). The wealthy segment of the society created their own sub-system of schooling and education in the form of private-like public schools and private schools. The school system that served the rest remained both insufficient in quantity and poor in quality. This issue will be revisited in more detail below.

The reality of Turkey does not easily fit into either of Coleman et al.'s (1966) or Heyneman and Loxley's (1983) perspectives. The answer to the question "does school quality or family background matter more to raise student achievement" seems to have the answer in Turkey "both are important." One contribution of this study to the discussion on relative effects sizes of school quality and family background on student achievement is that whatever (school quality, or family background) has a large variation in kind, and a logical link to student learning in the local context should be expected to have an effect on student achievement. In conclusion, the findings of this study call for a careful interpretation of Coleman et al.'s (1966) or Heyneman–Loxley's (1983) perspectives in the context of *each country* in question. Further, in our view, social capital theory suffers from the similar danger of overgeneralization. The insights gained from such theoretical frameworks should be carefully reinterpreted in the face of complex dynamics of the realities of each country under consideration.

The OECD average of between-school variance is 37% while the within-school variance is 63% (OECD, 2007a). In Turkey, the order of magnitude seemed to be reversed; between-school variance being 55% and within-school variance being 45%. This is true for both PISA 2003 and 2006 data (OECD, 2004; OECD, 2007a). In fact high levels of between-school variance seemed to hold for other measures of student achievement in Turkey such as *Student Selection Exam* while persisting to be in place for at least the last decade (Berberoglu and Kalender, 2005).

Our model was able to explain a large portion (82%) of the between-school variance. More than half (53%) is explained jointly by background and explanatory variables, about one-fifth (21%) is explained uniquely by school variables, and 8% is explained uniquely by background variables, leaving only 18% unexplained. The fact that the largest portion is explained jointly by background and school variables shows the interaction of school factors with socio-economic status of students served by schools.

In other words, students with similar socio-economic backgrounds are grouped into same schools in Turkey even within the public school system. There is indeed other evidence that students are grouped into schools in Turkey based on a pattern of family income, and that students from affluent backgrounds are more likely to be found in highly selective and academically oriented schools such as Science and Anatolian High Schools (Horn, 2008). It is worth noting that the percentage of students served by private schools which come from relatively affluent backgrounds is still small in Turkey: about 2.3% at the target age (Turkish Statistical Institute, 2006).

Between-school variance in student performance may conceptually be related to factors of the same school type or factors pertaining to different school types (such as general high schools, Anatolian high schools, and vocational high schools etc.). For example, there may be performance differences between schools of the same type such as a general high school in a wealthy neighborhood, and another general high school in a disadvantaged neighborhood. It is also the case that performance variance among *school types* is one dimension of the between-school variance, and hence is potentially related to between-school variance.

As shown in Fig. 2, students in Science High Schools, Anatolian High Schools, and Foreign Language Intensive High Schools have performance levels above OECD average in PISA 2006. Students in these schools however comprise only 12% of the Turkish sample. General and Vocational High Schools which together account for 77% of the Turkish sample in PISA 2006 have significantly lower

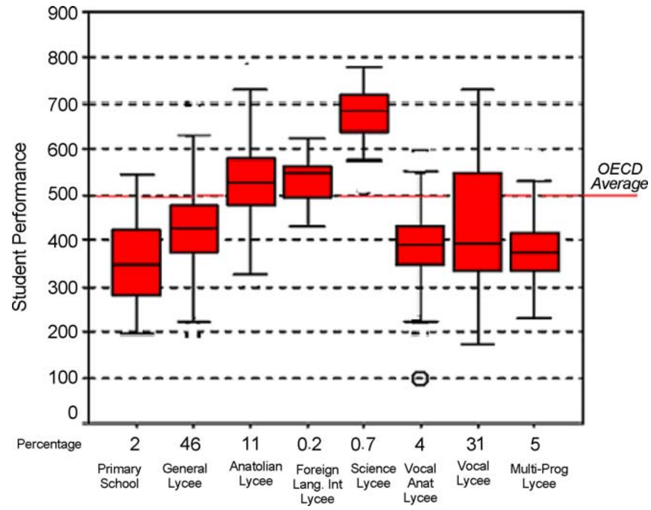

Fig. 2. Mathematical literacy scores by school type in Turkey: PISA 2006 (adapted from MONE, 2007b, p. 68).

overall performance. In these schools, students are not attaining mathematical literacy at the desired level as measured in PISA, while a small percentage of students in the three academically intensive and competitive schools perform above the average OECD level. These schools have strong academic programs in mathematics (MONE, 2008).

These observations coupled with the finding of this study show that weekly number of mathematics lessons in a school has a significant effect on student performance provide insights into why there is so much between-school variance in Turkey. It looks like Turkey can educate a minority of its youth reasonably well in only certain types of schools but in other schools where the great majority of students are, there is a large gap in the level of mathematical achievement. This is probably due to smaller opportunity with less than sufficient time to learn mathematics, lower quality of mathematics curriculum, and probably less than sufficient teacher quality in these schools. It is the practice in Turkey that best-prepared and qualified teachers are selected and placed into Science High Schools and Anatolian High Schools.

To reduce between-school variance in student performance, educational policy makers can take measures to compensate for the deficiencies in *school social capital*. This can again be accomplished by a more equitable distribution of inputs and spending. We believe this is important because there is considerable variation in the levels of spending per student in Turkey. Yilmaz (2006) reported that nine of the 10 provinces with the lowest per student spending in education are located in Eastern and South Eastern regions of Turkey. These provinces receive about 34% less per student spending compared to the students in the other provinces. Further, Turkey was the only OECD country that spent less public money per student at secondary level than per student at primary level in 1990s (State Planning Agency, 2001, p. 65). In practice, this means that for sometime now, public secondary education in Turkey has been neglected in general.

We also found in this study that being placed in schools in the Eastern and Southeastern regions has a significant negative effect on student performance. So it is reasonable to call for a more equitable distribution of teachers with better preparation, and resources such as educational materials, books, computers, materials that disadvantaged students might be missing at home into schools serving the students in the disadvantaged regions. Whatever resources are missing that would affect student performance in low performing schools should first be identified, and the money for school-based interventions should be targeted to compensate for these resources. Further, school curriculum can be improved to ensure that every student has a good chance of learning core mathematical skills and an appropriate time to do so in term of weekly mathematics hours regardless of school type or program. In his review of 60 studies on school effectiveness in developing countries, Fuller (1987) reports that quality of instructional materials and curriculum, length of instructional time, and teacher training have significant effects on the level of students' academic achievement especially in the fields of mathematics and science.

It is known that there is high teacher turn over in the Eastern and Southeastern regions, that there are issues with students' facility with Turkish language (Smits and Hoşgör, 2006). As the security situation improves in these regions, and the potential of the South Eastern Anatolia Project (the GAP project) is realized with more economic activity, coupled with a more careful and pointed handling of educational spending, things should move in the right direction.

Because there is large performance variation between Turkish schools, interventions can also target increasing the *functional social capital* by setting standards for school performance. It can be accomplished by setting minimum standards, expecting all schools to adhere to these standards, and then gradually raising the standard to higher levels (The World Bank, 2005). Also, based on data from other countries from PISA 2006, OECD reports higher overall performance in schools that keep track of student performance at a public level with publicly visible standards and results (OECD, 2007a).

Our analysis of PISA 2006 data revealed that among the variables considered in this study, the ones that showed a significant effect on student achievement are indeed limited in the three models. Table 5 gives a summary of the findings. For our purposes, the most interesting findings are the ones from the net model as it takes into account both background and explanatory school variables.

Among the background factors that seemed to have an effect on student achievement are the usual suspects predicted by the social capital theory: student ESCS and schools' average ESCS. According to OECD (2007a), the level of ESCS effect on student performance among Turkish students is highest among the participating countries in PISA 2006. If Turkish students had the same ESCS status as the average ESCS level in OECD countries, Turkish average score would be 39 points higher than it was in 2006. The findings of two other national studies yield similar results about the high effects of family background and socio-economic status on student achievement at primary school level (Engin-Demir, 2009; MONE, 2007a).

Gender seems to make a difference also in mathematical performance. For Turkey, the advantage of boys over girls is higher than the OECD average, being a boy brings about 16.43 points more in the PISA math scale, whereas the OECD average for boy-girl difference is 11 points (OECD, 2007a). Part of this may be a function of girls' relatively low rates of participation in education in general. Smits and Hoşgör (2006) report that girls are less likely to participate and be motivated to do well in school in the rural Eastern and Southeastern parts of the country and from households with illiterate mothers or mothers with low levels of education. The gender difference can be reduced or eliminated by raising awareness within communities and schools, and among teachers about equity for girls. In the last few years, with the campaigns like "girls, lets go to school!" government reports making significant headways in the right direction on this issue.

There are only two *functional school social capital* variables that seemed to make a difference in student performance after the effects of background variables were controlled: learning time for

Table 5
Summary of findings in the three models.

Model	Description of the model	Variables that were found to have significant effects on achievement in the 2nd level models
Background model	Taking into account only the background variables (ESCS and demographics)	1. Individual ESCS 2. Gender 3. School's average ESCS
The gross model	Taking into account only the explanatory variables (school factors)	1. Average number of students per teacher 2. Learning time for regular lessons 3. School's academic selectivity
The net model	Calculating the effects of explanatory variables *while* taking into account the effects of background variables	1. Learning time for regular lessons 2. School's academic selectivity 3. Individual ESCS 4. Gender 5. School's average ESCS 6. School's geographical region

mathematics and schools' academic selectivity. All students in grade 9 take four lessons a week worth of mathematics. There are however large differences between the weekly number of mathematics lessons offered among different programs from zero to six lessons a week for grades 10 and 11, and zero to eight lessons for grade 12 depending on the academic program the students are in. For example, students in the science intensive programs take six lessons of mathematics at grades 10 and 11, and eight lessons of mathematics at grade 12 whereas students in the social science intensive programs are required to take *no mathematics classes at all* after grade 9 (MONE, 2008). It is interesting to note that after socio-economic factors are taken into account, it is not the student-teacher ratio, but the weekly numbers of mathematics lessons students take that make a difference in their mathematical performance. Differential performance of students in different types of high schools (Anatolian, General or Vocational and Technical High Schools) may be mediated by the curriculum in these schools, one dimension of which is the weekly number of math lessons in the programs of these schools. This observation is not true for Turkish system only, it is reported that learning time in class as a strong factor effecting student performance in both developing and developed countries (Fuller, 1987; OECD, 2007a; Reynolds and Walberg, 1992).

The kind of mathematics measured in PISA is not rigorous academic mathematics. Rather it is the mathematical literacy that young people would use to do well in daily life. Defining core mathematical skills and designing curricula that reflect them plus ensuring that *everyone* has an opportunity to attain these skills regardless of their subsequent academic or vocational track seemed to be priorities in the Turkish educational system. Mathematics and science curricula have been reformed recently up to 8th grade to emphasize higher order thinking skills and active learning. The new curriculum should reflect mathematical literacy as measured by PISA better than the previous curriculum (MONE, 2005). It remains to be seen whether the curricular changes will help improve student performance in the coming cycles of PISA.

Even after SES is held constant, school selectivity in admitting students is a significant factor in explaining student achievement. There are now very competitive selection exams at every level in the Turkish educational system. Certain public schools (e.g., Anatolian High Schools) serve only 5% of the high school population and accept students through competitive central exams (State Planning Agency, 2001). Whatever it is that is making a student successful in the selection exams seems to be contributing to the performance of these few in PISA. However, the concern remains for the majority who cannot pass these exams, and who are placed in schools with lower educational qualities. OECD reports school systems with inflexible tracking practices like the situation in Turkey having a moderate negative effect on overall student performance internationally (OECD, 2007a).

In the Turkish context, many variables that seemed to make a difference in other cultures and which are predicted by the social capital theory such as school management and funding, school autonomy, school resources (except teaching time, but including student–teacher ratio), and school program type, do not seem to have a significant effect on student achievement. This may be due to the fact that Turkey has a centrally managed educational system, and many of the decisions regarding budget, curriculum, personnel, management and resources are made by the Ministry of National Education. Because there was not much variance in these variables, they might not have contributed to explaining student achievement.

Changing this situation will require a well-planned and targeted effort by increasing and distributing resources more equitably, reforming the curriculum, setting high standards for schools and holding them accountable while authorizing them to make decisions in their local contexts on appropriate matters of their expertise. It will also be necessary to continually collect and analyze information on the performance of educational system to gauge the direction of reform efforts. With this kind of sustained, comprehensive and well-planned reform will the country move towards its democratic ideal of serving the needs of all of its youth.

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References

Akşit, N., 2007. Educational reform in Turkey. International Journal of Educational Development 27 (2), 129–137.
Baker, D.P., Goesling, B., Letendre, G.K., 2002. Socioeconomic status, school quality, and national economic development: a cross-national analysis of the "Heyneman–Loxley" effect on mathematics and science achievement. Comparative Education Review 46 (3), 291–312.
Bali, V., Alvarez, R., 2003. Schools and educational outcomes: what causes the race gap in student test scores? Social Science Quarterly 84 (3), 485–507.
Bassani, C., 2005. A cross-national examination of the effect of family and school social capital on youth's mathematics scores in Canada, Japan and the United States. Unpublished Dissertation Study, University of Calgary.
Bassani, C., 2006. A test of social capital theory outside of the American context: family and school social capital and youth's math scores in Canada, Japan and the United States. International Journal of Educational Research 45, 380–403.
Berberoglu, G., Kalender, I., 2005. Investigation of student achievement across years, school types and regions: the SSE and PISA analyses. Eğitim Bilimleri ve Uygulama [Educational Sciences and Practice] 4 (7), 21–35.
Bourdieu, P., 1986. The forms of capital. In: Richardson, J. (Ed.), Handbook of Theory and Research for the Sociology of Education. Greenwood Press, New York.
Boyle, M., Lipman, E., 1998. Do places matter? A multilevel analysis of geographic variations in children behavior in Canada. Hull: Applied Research Branch,

Human Resources Development, Canada. http://www.hrdc-drhc.gc.ca/sp-ps/arb-dgra/publications/research/abw-98-16e.shtml (accessed 08.08.08).
Caldas, S., Bankston, C., 1999. Multilevel examination of student, school and district-level effects on academic achievement. The Journal of Educational Research 93, 91–110.
Cohen, S., Raudenbush, W., Ball, D.L., 2003. Resources, instruction and research. Educational Evaluation & Policy Analysis 25 (2), 119–142.
Coleman, J., 1987. Families and schools. Educational Researcher 16 (6), 32–38.
Coleman, J., 1988. The creation and destruction of social capital. Journal of Law, Ethics & Public Policy 3, 375–404.
Coleman, J.S., Campbell, E.Q., Hobson, C.J., McPartlant, J., Mood, A.M., Weinfall, F.D., York, R.L., 1966. Equality of Educational Opportunity. Department of Health, Education and Welfare, Washington, DC.
Ehmke, T., Siegle, T., 2005. ISEI, ISCED, HOMEPOS, ESCS: Indikatoren der sozialen herkunft bei der quantifizierung von sozialen disparitäten. Zeitschrift für Erziehungswissenschaft 8 (4), 521–540.
Engin-Demir, C., 2009. Factors influencing the academic achievement of the Turkish urban poor. International Journal of Educational Development 29, 17–29.
Fuller, B., 1987. What school factors raise achievement in the Third World? Review of Educational Research 57 (3), 255–292.
Goddard, R., 2003. Relational networks, social trust, and norms: a social capital perspective on student's chances of academic success. Educational Evaluation & Policy Analysis 25 (1), 59–74.
Grootaert, C., Van Bastelaer, T., 2002. Social capital: from definition to measurement. In: Grootaert, C., Van Bastelaer, T. (Eds.), Understanding and Measuring Social Capital: A Multidisciplinary Tool for Practitioners.. The World Bank, Washington, DC.
Günçer, B., Köse, M.R., 1993. Effects of family and school on Turkish students' academic performance. Education and Society 11 (1), 51–62.
Heyneman, S.P., Loxley, W., 1983. The effect of primary school quality on academic achievement across twenty-nine high- and low-income countries. American Journal of Sociology 88 (6), 1162–1194.
Horn, R., 2008. Education and global competitiveness. Paper presented at the International Conference on the Right to Education and Future Perspectives sponsored by Turkish Education Association, Ankara, January 28–30.
Jencks, C., Smith, M., Ackland, H., Bane, M.J., Cohen, D., Gintis, H., Heyns, B., Michaelson, S., 1972. Inequality: A Reassessment of Family and Schooling in America. Basic Books, New York.
Joshi, R., 1995. Why our students fail math achievement? Education 116 (1), 1–5.
Kalmijn, M., Kraaykamp, G., 1996. Race, cultural capital, and schooling: an analysis of trends in the United States. Sociology of Education 69, 22–34.
National Ministry of Education (MONE), 2005. Handbook for the New Primary School Programs. MONE Directorate of Education and Instruction, Ankara.
National Ministry of Education (MONE), 2007a. Report on Student Assessment Program (SAP) 2005: Mathematics. MONE Directorate of Education and Instruction, Ankara.
National Ministry of Education (MONE), 2007b. National Report on PISA 2006. MONE Directorate of Educational Research and Development, Ankara.
National Ministry of Education (MONE), 2008. Weekly hours of regular lessons in school programs. http://www.meb.gov.tr (accessed 04.09.08).
Morgan, S., Sorensen, A., 1999. Parental networks, social closure, and mathematics learning: a test of Coleman's social capital explanation of school effects. American Sociological Review 64 (5), 661–682.
O'Brien, V., Kopala, M., Martinezpons, M., 1999. Mathematics self-efficacy, ethnic identity, gender, and career interests related to mathematics and science. Journal of Educational Research 92 (4), 231–237.
Ostrom, E., 2000. Social capital: a fad or a fundamental concept? In: Dasgupta, P., Serageldin, I. (Eds.), Social Capital: A Multifaceted Perspective. World Bank, Washington.
Organization for Economic Co-operation and Development (OECD), 2007a. PISA 2006: Science Competencies for Tomorrow's World (Vol. 1: Analysis & Vol. 2: Data). OECD, Paris.
Organization for Economic Co-operation and Development (OECD), 2007b. Reviews of National Policies for Education: Basic Education in Turkey. OECD, Paris.
Parcel, T., Dufur, M., 2001. Capital at home and at school: effects on child social adjustment. Journal of Marriage and the Family 63 (1), 32–47.
Raudenbush, S.W., Bryk, A.S., 2002. Hierarchical Linear Models: Applications and Data Analysis Methods. Sage, London.
Raudenbush, S.W., Bryk, A., Cheong, Y.F., Congdon, R., 2008. HLM: Hierarchical Linear and Nonlinear Modelling (Version: 6.06) [Computer software] Scientific Software International, Inc., Lincolnwood, IL.
Reynolds, A., Walberg, H., 1992. A structural model of high school mathematics outcomes. The Journal of Educational Research 85 (3), 150–158.
Schreiber, J., 2002. Institutional and student factors and their influence on advanced mathematics achievement. Journal of Educational Research 95 (5), 274–285.
Smits, J., Hoşgör, A.G., 2006. Effects of family background characteristics on educational participation in Turkey. International Journal of Educational Development 26, 545–560.
State Planning Agency, 2001. Secondary Instruction: General, Vocational and Technical Education. State Planning Agency, Ankara.
Stevenson, H., Chen, C., Lee, S., 1993. Mathematics achievement of Chinese, Japanese, and American children: ten years later. Science 259, 53–58.
Tremblay, S., Ross, N., Berhelot, J.M., 2001. Factors affecting grade 3 student performance in Ontario: a multi-level analysis. Education Quarterly Review 7 (4), 25–36.
Turkish Statistical Institute, 2006. National Education Statistics: Formal and Non-formal Education 2004/'05. Turkish Statistical Institute, Ankara.
The World Bank, 2005. Turkey-Education Sector Study. The World Bank, Washington.
Wilkins, J., Ma, X., 2002. Predicting student growth in mathematical content knowledge. Journal of Educational Research 95 (5), 288–297.
Willms, J.D., 1996. Indicators of mathematics achievement in Canadian elementary schools. In: HRDC (Eds.), Growing up in Canada: National Longitudinal Study of Children and Youth. Human Resources Development Canada and Statistics Canada, Ottawa, Ontario, pp. 69–82.
Woessman, L., 2001. Why students in some countries do better? Hooever Institution, Stanford, CA. http://www.hoover.org/publications/ednext/3389816.html (accessed 08.08.08).
Yilmaz, H., 2006. Equality in primary and secondary education: looking into educational spending from this perspective. In: Paper presented at the World Bank and State Planning Agency Conference on Educational sector in Turkey, Ankara, March 17.