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Research Article

Who are the Most Disadvantaged? Factors Associated with the Achievement of Students with Low Socio-Economic Backgrounds

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Abstract

Analysis of the relationship between socio-economic status (SES) and student achievement has been prevalent in the literature, yet research focusing on the association between factors and the achievement of school populations with distinct categories of SES is limited. The purpose of the present study was to investigate various relevant student, household, and school factors associated with the performance of students with distinct SES backgrounds in Turkey. Specifically, this study aimed to compare the most disadvantaged students with the most advantaged ones in terms of factors affecting their reading, mathematics, and science achievement. The data for the study was taken from the latest Program for International Student Assessment (PISA), which was conducted in 2012. Several multiple linear regression models were employed in the analysis of the data. Results showed an enormous achievement gap between students in the lowest 25 SES percentile and those in the top 25 SES percentile in all subject areas, and suggested that socioeconomically disadvantaged students benefitted more from home educational resources and ICT availability, as well as reduced class size, compared to their counterparts from higher socio-economic backgrounds. The study provides substantial implications and suggestions for policy makers in general, and for those in Turkey in particular.

Keywords

Disadvantaged students • PISA • Socio-economic status • Student achievement • Turkey

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The achievement gap between distinct groups of students has increasingly been an important subject of focus in the contemporary educational literature, governments' educational policies (irrespective of their development level), and the endeavors of international organizations (such as UNESCO and World Bank), since education is proven to be a substantial strategy to reduce poverty and enhance individuals' and communities' overall living condition (Darling-Hammond, 2010; Fullan, 2006). A major body of educational policy research examined the achievement gap and found it to be substantial among those who were labeled as low socio-economic status (SES) and minority students (Crane, 1996; Desimone & Long, 2010; Delen & Bellibas, 2015; Flores, 2007; Haycock, 2001; Kober, 2001; Ladson-Billings, 2006; Lubienski, 2002). It is consistently found that unlike students with higher socio economic status SES backgrounds, students who suffer from lower SES living conditions are less likely to succeed in elementary and secondary schools and to attend a higher education institution (Daniel, 2009; Gelbal, 2008; Perry & McConney, 2010; Undheim & Nordvik, 1992). The issue is especially critical for successful low SES students. Wyner, Bridgeland, and Dilulio (2007), for instance, reported that high achieving low income students are more likely to fail during their primary and secondary education, and less likely to graduate from college when compared with their high-SES counterparts.

Many potential remedies to the problem are discussed in the literature. Some proposed solutions have put considerable pressure on schools. In many studies and articles, the school is considered a useful intervention in addressing the disadvantages associated with low SES backgrounds (e.g., Darling-Hammond, 2000; Haycock, 1998; Ingersoll, 2001; Jesse, Davis, & Pokorny, 2004; Koedel, 2009; Mosteller, 1995; Rivkin, Hanushek, & Kain, 2005; Sanders & Horn, 1998). Educational researchers found that the variation of achievement among students is larger between different schools than the variation within each individual school. This finding reveals the significant contribution of the teacher to student learning outcomes. Further research concluded that the teacher has a greater influence on student learning than any other school-related factors and that good quality teaching matters (Hanushek & Kain, 2005), particularly for students from disadvantaged backgrounds (Haycock, 2001; Koedel, 2009; Sanders & Horn, 1998). "Ensuring an adequate supply of well-qualified teachers in high-minority schools" is considered to be an effective way to deal with the achievement problem of low-SES students (Kober, 2001). Even though such research emphasizes the importance of effective teachers, measuring teacher effectiveness has been the subject of controversy, and not much has been done to assign teachers who are considered effective to schools with high concentrations of low-SES students. Yet, some other school policies, such as reducing class size, have been implemented and resulted in substantial academic gains for low-SES students (Mosteller, 1995).

Besides remedies aimed at improving students' education in schools, researchers have proposed various other policies and strategies for intervention programs to alleviate the

detrimental impact of SES on the academic achievement of lower SES students. The list of solutions they produced mostly suggested the importance of early childhood education, parenting, and household issues (Bellibas & Gumus, 2013; Darling-Hammond, 2010; Ingram, Wolfe, & Lieberman, 2007; Lareau, 1987, 2002, 2003; Rothstein, 2004; Scott-Jones, 1987). For instance, Darling-Hammond (2010) reports 2006 PISA results and argues that the U.S has the largest existing achievement gap among students with differing SES, when compared to other developed countries. In addition to assigning high quality teachers to vulnerable environments, Darling-Hammond highlights the importance of the provision of basic life needs for low-income students, as well as the creation of supportive early learning environments. Rothstein (2004), however, argues that strategies constrained to improving school-level factors such as teacher quality, high expectation and accountability, are not an adequate way of closing the achievement gap when employed without additional strategies because, according to his research, the gap stems primarily from childrearing differences among different social classes. Hence, Darling-Hammond argues that early childhood education is critical and should target all low-SES students. Similarly, Lareau (1987; 2002; 2003) and Kober (2001) propose that the gap between classes develops even before schooling age, due to lack of strategic childrearing practices among working-class and poor parents. The educational level of the mother plays a critical role at these ages since it determines the mother's level of engagement in the cognitive development and schooling of her children (Lareau, 2003; Pianta & Harbers, 1996). In addition, Rothstein (2004) mentions the importance of non-cognitive skills for the achievement of low-SES students. If low-SES students get involved in appropriate life experiences that help them develop critical non-cognitive skills—such as perseverance, self-confidence, and self-discipline—those skills might benefit them better than academic outcomes in their future lives.

Taking into account all critical issues raised in the literature, it has been obvious that “there is no simple explanation for the achievement gap. A variety of school, community, and home factors seems to underlie or contribute to the gap” (Kober, 2001 p. 5). The literature provides a comprehensive understanding of the relationship between various factors and student achievement, yet it yields modest insights into factors associated with the achievement of low-SES students. This is particularly true in the Turkish educational context, where the issue is hardly investigated (e.g., Altinyelken, 2009). The purpose of this research is therefore to investigate factors explaining the achievement of low-SES students and to provide an understanding of factors that are differently related to the achievement of low-SES students, compared to those that explain the achievement of high-SES students. This study examines the effects of various factors on the achievement of low and high-SES students in Turkey by using a recent large-scale national data set (PISA-2012) collected by the Organization for Economic Co-operation and Development (OECD). This research is especially important for policy makers and researchers in general, and

for those in Turkey in particular, in the sense that it attempts to identify the most important factors that contribute to increase in the success of low-SES students and narrowing the achievement gap between low and high-SES students. The specific research questions that lead the study are as follows:

1. What is the achievement gap between low-SES and high-SES students in Turkey, controlling for various student and school factors, as well as for student characteristics?
2. Which student, school, and household factors are more important for low-SES students than high-SES students?

Before moving to the methods section, a discussion of the literature on the relationship between SES and educational outcomes in Turkey, and on the recent educational policy movement toward equality in Turkey will be provided.

Context and Background

The issue of socio-economic status (SES) is particularly important in the Turkish educational context because it has been found that in Turkey, as poverty level increases, not only does the achievement gap between students of differing SES expand, but the visibility of gender disparity also increases. A significant relationship exists between income level and student achievement within the country, and hence reducing poverty is considered an important means to improve student achievement (UNESCO, 2012).

A number of researchers in Turkey have focused their work on inequality among Turkish students by examining the relationship between socio-economic background and student test scores. For instance, Alacaci and Erbaş (2010) investigated the influence of a large number of school, household, and student factors on students' mathematics achievement by using 2006 PISA data; they concluded that SES was one of the most crucial predictors of mathematics outcomes. According to Aydin, Sarier, and Uysal (2012), the gap between mathematics performance of low and high-SES students is the largest in Turkey when Turkish students were compared to students in top ranking countries in international tests. Tomul and Savasci (2012) suggested that SES is a critical predictor of student achievement, and that it is even more critical for students in lower grade levels. Berberoglu and Kalender (2005) indicated that the achievement gap stemmed mainly from school differences, meaning that stratification of schools occurs as a result of SES and national tests that cause wide discrepancies in achievement between students attending different schools. Supporting this, Gumus and Atalmis (2012) found a considerable gap among school types and regions in Turkey, which is often seen as a product of SES differences.

In response to this problem of inequality as highlighted by researchers, the Turkish Ministry of Education introduced and implemented several educational policies over

the last decade aimed at alleviating the achievement gap between schools. One of the most critical problems in Turkey is low literacy rates among adults, particularly women (Kartal, 2007). The Ministry has long been working on increasing the literacy rates among mothers. In addition to Ministry, several other national non-profit organizations, such as the Mother Child Education Institution, are dedicated to augmenting the number of women who can read and write (Akay & Ültanır, 2010). Efforts to increase literacy rates and educational level among mothers are considered a considerable investment, since the research suggests that such investment has an even greater return for the wealth of the family and the success of the mothers' children (Rizvi & Lingard, 2009). Efforts helped to make great progress in increasing mothers' literacy skills, such that the rate of illiterate women in Turkey decreased to 9.4% in 2013 (Türkiye İstatistik Kurumu [TÜİK], 2015).

Aligned with the endeavor to increasing literacy rates among mothers, both current and previous governments have spent enormous effort to close the achievement gap between genders. Gender equality policy in education was initially centered on achieving greater access, particularly to the compulsory primary schools. The most compelling effort is the campaign launched by the Ministry of Education, called "Girls, Lets Go to School," which aims to enroll a hundred percent of girls in primary schools (Gumus & Gumus, 2013) and to "keep them at school with regular attendance rate" (Yazan, 2014 p. 853). The campaign started in 2003, initially focusing on the eastern and southeastern parts of the country—where the educational attainment gap between boys and girls is the largest—and then extended to other parts of the country in following years (Yıldız, 2006). Gumus and Gumus (2013) analyzed the impact of the campaign and found that it increased the access rate among girls, not only to primary schools but also to secondary schools. Although the gender gap in educational attainment was reduced to a certain degree, inequalities in educational outcomes still exists.

One of the recent policy efforts for addressing the inequalities in educational outcomes is the Ministry's commitment to extend the availability of technology in the classroom by introducing the "Movement of Enhancing Opportunities and Improving Technology" project, nationally known as FATİH. The scope of the project includes providing each classroom with an interactive smart board and each student with a PC tablet. The five main components of the project involve "providing equipment and software substructure, providing educational e-content and management of e-content, effective usage of the ICT in teaching programs, in-service training of the teachers, and conscious, reliable, manageable and measurable ICT usage." With this project, the Ministry aims to "provide equal opportunities to everybody on learning and usage of the information and communication technologies." The project started in 2012 and is anticipated to conclude in five years (FATİH Project, 2012).

Another important attempt by the Ministry of Education to close the achievement gap involved reducing the student-classroom ratio by increasing the number of school buildings nationwide. According to Çelik and Gür (2013), “in 2002, the average number of students per class and student-teacher ratio was approximately 30. By 2012, the average number of students fell to 22 in primary schools, 27 in secondary schools, and 23 in high schools” (Çelik & Gür, 2013 p. 156).

Reviewing the literature and recent policy initiatives by the Ministry of Education in Turkey, it becomes apparent that little research has been conducted to assess the effectiveness of these policy movements. Although researchers provide persuasive evidences that SES is a substantial predictor of student outcomes, they still fail to provide an understanding of the actual gap between different SES groups, as well as which student, household, and school factors might be more critical for achievement of low-SES students and therefore the potential impact of current policy movements designed by the Ministry.

Methods

In this study, a quantitative method utilizing inferential statistics was employed. Inferential statistics is a part of general linear model and includes several methods, such as t-test, Analysis of Variance (ANOVA) and regression. In this particular research, multiple regression model was employed. This section starts with an articulation of the data sources and the sample used in the study. It then introduces dependent and independent variables. Lastly, it lays out details concerning the analysis of the data.

Data Source

The data for this study comes from the latest PISA (Program for International Student Assessment), collected by the International Organization for Economic Co-operation and Development (OECD) in 2012. PISA is conducted with the aim of measuring 15-year-old students’ skills in three main school subjects—mathematics, science, and reading—in many OECD and non-OECD countries around the world. Since most of the participating students are toward the end of their compulsory education, PISA aims to explore students’ ability to use their knowledge and skills in real life, and to find out whether they are ready to face the challenges of today’s world (OECD, 2012). PISA was first conducted in 2000 in 43 countries, and continued to be implemented every three years (2003, 2006, and 2009). Turkey has been participating in PISA since 2003. In the latest implementation (PISA-2012), which involved 65 countries (34 OECD and 31 partner countries) around the world, 4,848 students from 170 schools across 50 provinces participated in Turkey (Milli Eğitim Bakanlığı [MEB], 2013).

Sample

Several data sets are available through PISA, including student, school, parent, cognitive item, and scored cognitive item samples. In this study, only student and school data sets gathered in Turkey were used, due to the scope of the study. The school data set included 170 randomly selected schools, and involved multifaceted information regarding the features of the school, relying on responses from principals. The total number of students participating in PISA (student data set) in Turkey was 4,848, as indicated above (MEB, 2013).

Variables

The main dependent variable of the study is students' test scores in three subject areas: mathematics, science and reading. "Plausible value 1" for students' scores for each subject (math, science and reading) were employed as dependent variables. In this way, the study attempts to examine the variation in students' math, science, and reading test scores.

The study also includes several independent variables. The most critical independent variable is student socio-economic status (SES). In the PISA data set, the variable ESCS (Index of Economic, Social and Cultural Status) corresponds to well-known SES. This variable was divided into three, in order to successfully address the second research question, which aims to compare the most disadvantaged group with the most advantaged one in terms of factors affecting students' achievement. In such case, students in the lowest 25% of the ESCS variable represent low-SES students, while those among the highest 25% of the ESCS variable represent high-SES students, and those in the middle 50% of the ESCS variable represent medium-SES students, respectively.

Other independent variables include two dummy variables (gender and language at home) and eight continuous variables (mother education, perseverance, home educational resources, quality of school educational resources and physical infrastructures, class size, total school enrollment, and ICT availability at home). Variables were selected taking into account several policy initiatives in Turkey, as well as the related national and international literature.

Table 1
Demographic Information by SES Levels and Gender

Variables		Low SES	Medium SES	High SES	Total
Gender	Male	599	1237	641	2477
	Female	632	1146	592	2370
	Total	1231	2383	1233	4847

As seen in the Table 1, the number of low-SES student is 1231, which includes 599 male and 632 female students. The number of high-SES students is 1233, which

is very close to the number of low-SES students. Among all high-SES students, 641 are male and 592 are female. Finally, the total medium-SES students are 2383, which involve 1237 male and 1146 female students. The total number of participants is 4847.

Data Analysis

The first research question inquiries into the achievement gap between low-SES and high-SES students. To provide an answer to this question, a multiple regression was used, where students' scores in each subject (reading, math, and science) was employed as a dependent variable, SES levels (low-SES and high-SES), as well as other variables (gender, language, mother education, perseverance, home educational resources, quality of school educational resources and physical infrastructures, class size, total school enrolment, and ICT availability at home) were employed as independent variables. The results indicate an achievement gap in math, science, and reading across all three SES levels (high, medium and low). All independent variables can be grouped into three categories: student factors (SES, gender, language, and perseverance), household factors (mother education, home educational resources, and ICT availability at home), and school factors (quality of school educational resources and physical infrastructures, class size, and total school enrolment). SPSS 22.0 statistical software was employed to carry out specified data analysis.

Below, a set of linear models with the standard ordinary least square (OLS) assumptions are specified. Equations 1–3 correspond with multiple regression analyses conducted to address the first question.

$$\text{Reading}_{ij} = \beta_0 + \beta_1(\text{Low SES})_{ij} + \beta_2(\text{High SES})_{ij} + \beta_3(\text{Student})_{ij} + \beta_4(\text{Household})_{ij} + \beta_5(\text{School})_{ij} + \varepsilon_{ij} \quad (1)$$

$$\text{Mathematics}_{ij} = \beta_0 + \beta_1(\text{Low SES})_{ij} + \beta_2(\text{High SES})_{ij} + \beta_3(\text{Student})_{ij} + \beta_4(\text{Household})_{ij} + \beta_5(\text{School})_{ij} + \varepsilon_{ij} \quad (2)$$

$$\text{Science}_{ij} = \beta_0 + \beta_1(\text{Low SES})_{ij} + \beta_2(\text{High SES})_{ij} + \beta_3(\text{Student})_{ij} + \beta_4(\text{Household})_{ij} + \beta_5(\text{School})_{ij} + \varepsilon_{ij} \quad (3)$$

The second question aims to compare low-SES students with high-SES students, in order to identify variables that have a particular contribution to the achievement of low-SES students. To answer this question, the dataset was first divided into two SES groups (low and high). Then, a multiple linear regression was run for each SES group, where three subjects (reading, mathematics, and science) function as dependent variables, and other factors (gender, language, mother education, perseverance, home educational resources, quality of school educational resources and physical infrastructures, class size, total school enrolment, and ICT availability at home) function as independent variables.

Another set of linear models with the standard OLS assumptions are specified below. Equations 4–6 are related to multiple regression analyses conducted to address the second research question.

$$\text{Low SES Reading}_{ij} = \beta_{ij} + \alpha(\text{Student})_{ij} + \gamma(\text{Household})_{ij} + \delta(\text{School})_{ij} + \varepsilon_{ij}$$

$$\text{High SES Reading}_{ij} = \beta_{ij} + \alpha(\text{Student})_{ij} + \gamma(\text{Household})_{ij} + \delta(\text{School})_{ij} + \varepsilon_{ij} \quad (4)$$

$$\text{Low SES Math}_{ij} = \beta_{ij} + \alpha(\text{Student})_{ij} + \gamma(\text{Household})_{ij} + \delta(\text{School})_{ij} + \varepsilon_{ij}$$

$$\text{High SES Math}_{ij} = \beta_{ij} + \alpha(\text{Student})_{ij} + \gamma(\text{Household})_{ij} + \delta(\text{School})_{ij} + \varepsilon_{ij} \quad (5)$$

$$\text{Low SES Science}_{ij} = \beta_{ij} + \alpha(\text{Student})_{ij} + \gamma(\text{Household})_{ij} + \delta(\text{School})_{ij} + \varepsilon_{ij}$$

$$\text{High SES Science}_{ij} = \beta_{ij} + \alpha(\text{Student})_{ij} + \gamma(\text{Household})_{ij} + \delta(\text{School})_{ij} + \varepsilon_{ij} \quad (6)$$

According to Osborne and Waters (2002), there are four essential assumptions that researchers should test when employing multiple regression analysis in their research. The first assumption is that variables are normally distributed. To check whether the normal distribution is the case, histograms and Q-Q-Plots were used. The second assumption is that the relationship between independent and dependent variables should be linear. This was tested using scatter plots. A third assumption for multiple regression is the issue of multicollinearity. This assumption is hold when there is little or no correlation among independent variables. A correlation matrix was employed to check if there was any multicollinearity among independent variables. Finally, autocorrelation is another assumption to take into account. This occurs if the residuals are not independent from one another. This was checked employing scatter plots.

Results

These findings section addresses each of the research questions in turn. It begins with the first question, which aims to understand the achievement gap across the three SES groups: low, medium, and high. The focus then moves to the second question, which inquiries into the factors that have different effects on low and high-SES groups.

The Achievement Gap among Low, Medium, and High-SES Student Groups

Table 2 summarizes results for Equations 1–3, revealing an achievement gap between low, medium and high-SES students.

The regression equations explained 32%, 30%, and 25% of the total variation in students' reading, mathematics, and science scores, respectively. Because low and high-SES groups were included in each regression equation, the remaining students—those from medium SES backgrounds—are considered as the reference group, in which case the coefficients are interpreted in terms of difference between low and medium and between high and medium-SES groups. Based on this information, Table 2 indicates that low-SES students scored fewer points than medium-SES students by an average of 3.54 in reading, 6.82 in mathematics, and 0.46 in science. Such differences between the

Table 2

Achievement Gap between Low and High-SES Students in Reading, Mathematics, and Science Tests

Variables	Reading	Mathematics	Science
	β	β	β
Low Socio-Economic Status	-3.538	-6.817	-.455
High Socio-Economic Status	28.973***	28.058***	19.296***
Gender (Female)	37.579***	-21.531***	.939
Language (other)	-22.140***	-12.079	-11.432
Mother education	3.324**	3.535**	2.752**
Perseverance	11.736***	11.728***	7.442***
Home educational resources	13.308***	13.987***	12.686***
Quality of School Educational Resources	9.941***	16.312***	12.683***
Quality of School Physical Infrastructures	4.616**	1.168	3.199*
Class size	-.629***	-.834***	-.513***
School Enrolment	-.024***	-.036***	-.031***
ICT Availability at Home	.306	2.001	1.514

* $p < .05$, ** $p < .01$, *** $p < .001$

Reading: $R = .569$, $R^2 = .324$, Adjusted $R^2 = .316$, $F_{(12, 1138)} = 38.962$, $p < .001$; Math: $R = .544$, $R^2 = .296$, Adjusted $R^2 = .287$, $F_{(12, 1138)} = 34.175$, $p < .001$; Science: $R = .504$, $R^2 = .254$, Adjusted $R^2 = .245$, $F_{(12, 1138)} = 27.644$, $p < .001$.

two groups are not significant, meaning that there is only a small disparity between low and medium-SES students in reading, mathematics, and science test scores. Similarly, medium-SES students scored fewer points than high-SES students by 28.97 in reading, 28.06 in mathematics, and 19.30 in science, but those differences are statistically significant ($p < .001$). This also means a significant difference between low and high-SES students, with high-SES students scoring 32.51 points higher than low-SES students in reading, and 34.88 points in mathematics. The result, overall, suggests the existence of a statistically significant achievement gap between low and high-SES, as well as between medium and high-SES student groups (See Figure 1).

Table 2 also suggests that, except for the variable of ICT availability at home, all other variables turned out to be significant predictors of students' reading, mathematics, and science scores. The results show that students with a first language other than Turkish earn significantly lower scores, but only in reading tests. Several other variables—including mother's education, perseverance, home educational resources, quality of school educational resources, class size, and total school enrollment—appear to be significant predictors of student achievement in all subject areas. This suggests that students who have higher levels of perseverance, better educational resources at home, and whose mothers have attained higher educational levels, as well as those who attend schools with a higher quality of educational resources, smaller class size, and total enrollment, are more likely to achieve better test scores in all subject areas. There were some other findings as well. For instance, while on average female students outperformed their male counterparts in reading, male students outperformed females in mathematics tests, and both groups' science scores were very similar.

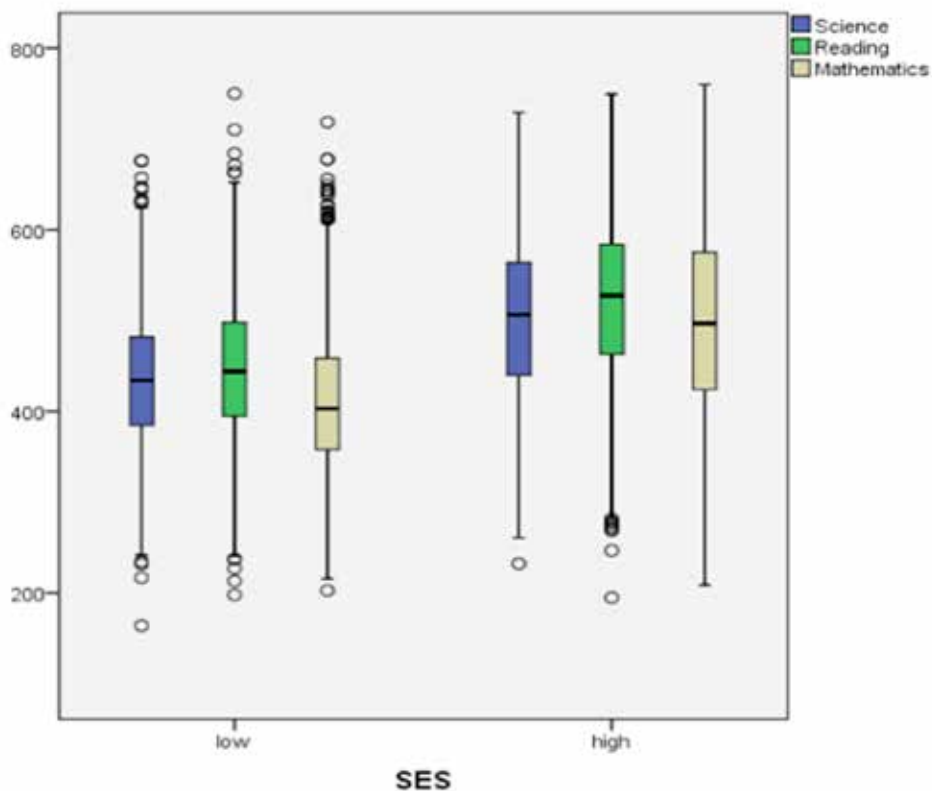


Figure 1. Achievement gap between low and high-SES students in reading, science and mathematics.

Although such results provide important information regarding the achievement gap between high and low-SES students, as well as factors affecting achievement of all students, it is unable to reveal whether any of such factors has distinct effect on different SES groups.

Factors that are More Important for Low-SES Students than High-SES Students

This questions aims to reveal factors that have a distinct effect on low and high-SES groups, to enhance understanding of which factors matter the most for success, particularly for the success of low-SES students. Table 3 summarizes results for equations 4–6, each of which compare low and high-SES students in terms of factors affecting their reading, mathematics, and science achievement.

Equations 4, 5, and 6 in Table 3, compare low and high-SES students in terms of factors predicting their reading, mathematics, and science achievement, respectively. All regression equations explained 26% of total variation in low-SES students' reading scores, and 30% of total variation in high-SES students' reading scores; 18% of total variation in low-SES students' mathematics scores and 27% of total variation

Table 3
Factors Predicting the Achievement of Low and High-SES Students in Reading, Mathematics, and Science Tests

Variables	Reading		Mathematics		Science	
	Low SES (β)	High SES (β)	Low SES (β)	High SES (β)	Low SES (β)	High SES (β)
Gender (Female)	44.11***	43.46***	-11.84*	-17.33**	7.70	2.30
Language (other)	-23.91**	-27.25	-12.79	-6.12	-16.06*	-27.72
Mother Education	-4.56	6.54***	4.98	6.13***	-.10	6.00***
Home Educational Resources	12.02***	5.96	12.24***	5.39	13.86***	6.05
Perseverance	14.40***	7.21**	14.21***	8.35**	9.89***	5.75*
Quality of school Educational Resources	12.58***	11.77**	15.72***	15.35***	14.00***	10.07**
Quality of Physical Infrastructure	-2.09	11.26**	-6.95*	13.24**	-4.29	11.10**
Class Size	-0.56*	-.14	-.78**	-.41	-.43	-.11
Total School Enrolment	-.01**	-.05***	-.02***	-.06***	-.02***	-.05***
ICT Availability at Home	7.07**	-4.90	8.42**	-6.43	6.90**	-5.05

* $p < .05$, ** $p < .01$, *** $p < .001$.

Note. Low Reading: $R = .509$, $R^2 = .259$, Adjusted $R^2 = .248$, $F(10, 719) = 25.096$, $p < .001$; Low Math: $R = .427$, $R^2 = .183$, Adjusted $R^2 = .171$, $F(10, 719) = 16.069$, $p < .001$; Low science: $R = .418$, $R^2 = .175$, Adjusted $R^2 = .164$, $F(10, 719) = 15.265$, $p < .001$; High Reading: $R = .550$, $R^2 = .303$, Adjusted $R^2 = .293$, $F(10, 737) = 31.989$, $p < .001$; High Math: $R = .520$, $R^2 = .270$, Adjusted $R^2 = .260$, $F(10, 737) = 27.310$, $p < .001$; High science: $R = .491$, $R^2 = .242$, Adjusted $R^2 = .231$, $F(10, 737) = 23.470$, $p < .001$.

in high-SES students’ mathematics scores; 18% of total variation in low-SES students’ science scores, and 24% of total variation in high-SES students’ science scores.

The results from three regression equations indicated that female students outperform their male counterparts in reading, irrespective of their SES; that is, both in low ($\beta = 44.11$, $p < .001$) and high-SES ($\beta = 43.46$, $p < .001$) groups, girls gained significantly higher reading scores than their male counterparts. The opposite was the case for the mathematics test, however; that is, male students outperformed their female counterparts in mathematics among both low ($\beta = -11.84$, $p < .001$) and high-SES student groups ($\beta = -17.33$, $p < .001$). However, in terms of science scores, no significant difference was found between male and female students among both the low and high-SES student groups.

The results for language are different than those for gender. Low-SES students scored significantly lower if they spoke a first language other than Turkish ($\beta = -23.91$, $p < .01$). Differences in achievement due to language also exist among high-SES students, though the result is not statistically significant. The language factor did not appear to be as important a contributing factor for students’ mathematics scores. However, a significant difference was found in science scores between those with Turkish as their first language and those who spoke a different native language. Similar to the case in reading scores, the significant difference occurred only among low-SES students ($\beta = -16.06$, $p < .05$). Yet, interestingly, mother’s education seemed

to be a more important factor for high-SES students than it did for low-SES students. While a one point increase in mother education provided high-SES students with a 6.54 point increase in reading scores, it did not make much difference for low-SES students. The situation is similar for mathematics and science tests.

On the other hand, there are several variables—including home educational resources, class size, and ICT availability at home—that seemed to be more important for the achievement of low-SES students. According to the study results, a one point increase in low-SES students' home educational resources was associated with a 12.02 point increase in their reading scores ($p < .001$). An additional unit increase in home educational resources did not make much difference among high-SES students, however. The same was also true for students' mathematics and science scores. While a one point increase boosted low-SES students mathematics performance by 12.24 points and science performance by 13.86 points ($p < .001$), it did not make a statistically significant difference for the achievement of high-SES students. Similarly, low-SES students substantially benefitted from reduced class size and availability of ICT at home, whereas these two factors seemed not to contribute as much to the success of high-SES students. Specifically, a one point decrease in class size was found to be associated with 0.56 point increase in low-SES students' reading scores ($p < .05$), and a 0.78 point increase in mathematics scores ($p < .01$). Finally, a one point increase in ICT availability at home boosted low-SES students' reading scores by 7.07 points ($p < .01$), mathematics scores by 8.42 points ($p < .01$) and science scores by 6.90 points ($p < .01$), while ICT availability at home did not make much difference for high-SES students .

Perseverance also appeared as an important factor for both low and high-SES students' reading scores. Specifically, a one point increase in perseverance was associated with a 14.4 point increase in low-SES students' reading scores ($p < .001$), while the same increase corresponded with a 7.21 point increase in high-SES students' reading scores ($p < .01$). In terms of other subject areas, while a one point increase in perseverance corresponded to a 14.21 point increase for mathematics scores ($p < .001$) and a 9.89 point increase for science scores ($p < .001$) for low-SES students, it increased high-SES students' test scores by 8.35 points ($p < .01$) for mathematics and 5.75 points ($p < .05$) for science. Similarly, the results indicated that a higher quality of educational resources and smaller total school enrollments have positive effects on the reading, mathematics, and science scores of both low and high-SES students.

Discussion and Conclusion

Researchers and policy makers in many developing and developed countries, as well as international organizations, have exerted substantial effort to understand and

alleviate the achievement problems of students in general, particularly those who suffer from pernicious conditions embedded in low SES (Darling-Hammond, 2010; Kober, 2001). This study aimed to provide an understanding of the achievement gap between low and high SES students, and the factors that have different effects on distinct SES groups in Turkey, relying on the information from the PISA 2012 data set. Results suggest important implications for the factors that researchers, policy makers, and educators should focus their attention on the most.

The Most Vulnerable Students

The study started with an attempt to understand the achievement gap between low and high-SES students in three subject areas: reading, mathematics, and science. The results illustrated the existence of a substantial gap between students within the top 25 SES percentile and bottom 25 SES percentile, as well as between top 25 SES percentile and medium 50 SES percentile in all subject areas. A significant gap was not found between bottom 25 SES percentile and medium 50 SES percentile student groups. This implies that high-SES students benefit substantially from their SES, while low and medium-SES groups remained almost equal in terms of achievement. A great deal of research studies corroborate this finding (e.g., Crane, J. 1996; Caldas & Bankston, 1997; Darling-Hammond, 2010; Desimone & Long, 2010; Flores, 2007; Kober, 2001; Marks, Cresswell, & Ainley, 2006; Perry, & McConney, 2010). The results further suggested that low-SES students whose home language is other than Turkish are even more vulnerable to underachievement, particularly in the case of the reading test. These students are often identified as “at risk students” in developed countries, and researchers have suggested specific programs for them, such as early interventions (Darling-Hammond, 2010; Lesaux, & Siegel, 2003) and specialized teaching programs (Celce-Murcia & McIntosh, 1991), in order to reduce the negative effect of language on academic achievement of non-native-speaking low-SES students. Yet, there is currently not any policy in place to address the needs of such students in Turkey. Due to the strictly standardized nature of curriculum, as well as financing and staffing matters (Çelik & Gür, 2013), no additional support is provided to students who suffer from underachievement due to poor language skills. If the gap between disadvantaged and privileged groups is to be closed, or at least narrowed, it is essential to develop policies offering remedies to improving those students’ language skills.

Factors Affecting the Achievement of Low-SES Students

The second question of the study aimed to provide a full understanding of difference in factors affecting the achievement of low and high-SES student groups. The results indicated that home educational resources, reduced class size, and ICT availability at home are three the most critical factors that have substantial contribution to the

achievement of low-SES students in all subject areas, compared with high-SES students. Many researchers have indicated that differences between students with different SES backgrounds appear even before they begin attending schools (Darling-Hammond, 2010; Lareau, 1987; Lee & Burkam, 2002). There are many factors contributing to such inequality, and one of them has been found to be home educational resources. For instance, Roscigno and Ainsworth-Darnell (1999) concluded that home educational resources, which have a strong and positive effect on student GDP and standardized tests, are differentiated significantly based on student SES backgrounds. The reason why more home educational resources do not help high-SES students significantly improve scores can be explained through the fact that those students have already acquired a sufficient amount of resources that can prepare them for school, and the amount of resources beyond what they possess has no power for additional academic gain. However, even a small increase in the availability of home educational resources might produce considerable benefits for low-SES students, who often suffer from lack of minimum educational resources at home.

The results suggested that ICT availability at home did not contribute much to the increase in the achievement of high-SES students, but that it has substantial benefit for low-SES students. Consistently, Delen and Bulut (2011) found that usage of ICT at home provided students with significant gains in terms of both mathematics and science achievement, and contributed to closing the achievement gap. Although Aypay (2010) found no relationship between the use of ICT and student learning, his study did not take into account the fact that ICT might have different effects based on students' SES groups. A study by Chandra and Lloyd (2008) concluded that ICT improved students' scores as measured by standardized tests, and that the gains tend to be more substantial for low performing students. Similarly, Kim and Chang (2010) suggested that the use of computers can contribute significantly to narrowing the achievement gap between students with different backgrounds. In their study investigating the relationship between use of computers on students' reading scores through PISA 2006 data, Gumus and Atalmis (2011) concluded that, while use of computers for entertainment purposes significantly increased student reading achievement, it actually significantly reduced students' scores when those students used computers for educational purposes. This study implies that ICT use is beneficial only for the acquisition of basic skills that are crucial for the success of low-SES students. Overall, it makes sense to argue that the findings in this study together, with the literature, supported the current effort by the Turkish Ministry of Education, who has been supporting a substantial technology movement by providing each student with a tablet PC as a means to achieve greater equality among students with different SES backgrounds (Akcaoglu, Gumus, Bellibas, & Boyer, 2015). This project might serve as leverage for narrowing the gap between low and high-SES students by providing low-SES students with the basic skills necessary for increased educational outcomes.

Besides home educational resources and ICT availability, this study found that class size has greater benefits for low-SES students than it does for high-SES students. Consistent with the current research [Nye, Hedges and Konstantopoulos \(2000\)](#) found that the effect that small class size has is significant enough to be considered by policy makers. However, unlike what is found in this study, they stressed that “small classes benefit students of all types in all kinds of schools” (p. 147). Another study by [Mosteller \(1995\)](#) examines the impact of reduced class size on student test scores in 17 school districts filled with low-SES students, and found that all of these districts improved their average test scores in mathematics and reading. This study also supports the Ministry’s effort in the last decade to increase the number of school buildings, and hence reduce teacher-student ratio. Such efforts can provide increased opportunities to low-SES students in their interaction with their teachers, assuming that the policy does not ignore regions with high concentrations of low-SES students.

Factors for which SES does not Matter

The results showed that SES does not matter much for the achievement gap between genders. Female students consistently outperform their male counterparts in reading, whereas male students outperform their male counterparts in mathematics, and there exists no significant difference between female and male students in terms of their science achievement, irrespective of the students’ SES levels. This finding contradicts with the [UNESCO \(2012\)](#) report, which suggested that the gap between female and male students becomes more visible with the increase in the poverty rate. Other researchers provided evidence consistent with the current research. For instance, [McGraw, Lubienski, and Strutchens \(2006\)](#) found that gender gap in mathematics favors male students, and further indicated that male students possess more positive self-concept and attitudes toward mathematics. In terms of reading scores, international assessments have shown a significant difference between male and female students, favoring female students ([OECD, 2012](#)). Yet, the issue of gender gap in terms of science achievement is more controversial ([Delen & Bellibas, 2015](#)). [OECD \(2012\)](#) suggested that the difference between genders in terms of science scores is negligible, since it is not significant between genders.

The results also suggested that students’ sense of perseverance, school educational resources, and total school enrollment are substantially important for both low and high-SES students. The study suggested that students who have a higher sense of perseverance, and who attend a school with a fewer number of students and higher quality of educational resources, are more likely gain higher scores in all three subject areas, regardless of their SES backgrounds.

To summarize, there has been an increasing demand in many developed and developing countries for identifying disadvantaged groups and factors that determine

the achievement of such groups. As a result of the attempt to address this need in the Turkish context, this research resulted in three fundamental conclusions. First, there exist substantial achievement gaps between low and high-SES groups. Second, among low-SES groups, those who speak Turkish as a second language are even more vulnerable. Third, unlike for high-SES students, home educational resources, ICT availability at home, and reduced class size are three key factors that substantially benefit low-SES students. This study concludes that any educational policy in Turkey that aims to address the achievement gap inherent in distinct SES groups should place special attention on these fundamental factors.

The educational policy movements in Turkey have made substantial progress in the last decade in a number of aspects. Although it is still below OECD average, overall student achievement as measured by international tests has increased. The government has considerably improved access to and enrollment in education in all school levels, and consequently the gap between boys and girls in terms of educational attainment is almost closed at all levels. Furthermore, to address the existing inequality, the Turkish government has implemented policies to extend the availability of computers at home by providing each student with a tablet PC and to reduce class size by constructing a considerable number of new school buildings (Çelik & Gür, 2013). The research findings in this study support such efforts. Yet, this work also suggests that more should be done. For instance, not much has been done in terms of enriching low-SES students' homes with educational resources, nor for providing supplemental support for students suffering from a lack of effective language skills. This probably requires policy changes beyond the Ministry of Education, and the involvement of other institutions such as the Ministry of Family and Social Policies.

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