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Variables Associated with Students' Science Achievement in the Programme for International Student Assessment (PISA 2009)

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Abstract – The aim of this study was to analyze some of the variables that affect Turkish students' success in science using data from the PISA 2009 student survey. The universe for the investigation comprised 15-year-old Turkish students who were completing their compulsory education. The sample consisted of 4996 students who were selected through stratified sampling from this universe. Missing data were examined before analysis commenced and missing data were excluded from the analysis. The final sample comprised 4388 students. Independent t-tests, analysis of variance (ANOVA) and multiple comparisons were used in accordance with the purpose of the study. The results showed that there was a significant difference between students' success in science and a number of variables, namely, gender, school type, region, pre-school education, parents' education level.

Key words: Pisa 2009, science education, science achievement.

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Summary

Introduction

Over the past decade, the rapid spread of globalisation and a range of technological and economic developments have changed people's daily lives and highlighted the need for reform (Sun, Bradley & Akers, 2012). Countries wishing to move ahead have entered into co-operative arrangements, both nationally and internationally, with a range of social, cultural,

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economic and political organisations. One such multi-purpose organisation is the Organisation for Economic Co-operation and Development (OECD), of which Turkey is a founder member. In accordance with common goals, OECD members share ideas and experiences, solve problems and create new opportunities (Woodward, 2009). Because a trained workforce is essential for all countries to meet the needs of the modern era, the OECD gives high priority to education (Organisation for Economic Co-operation and Development [OECD], 2010b).

One of the largest international education research projects is the Programme for International Student Assessment (PISA), which is conducted by the OECD at three-yearly intervals. This is a screening study designed to measure the knowledge and functional skills of 15-year-old students nearing the end of their compulsory formal education (Anagnostopoulou, Hatzinikita, Christidou & Dimopoulos, 2013; Wu, 2009). PISA focuses on assessing young people's ability to use their knowledge and skills to overcome practical difficulties in everyday life (Cheng, 2012). By facilitating cross-country comparisons, the results of PISA assessments can inform future education planning and policy development as well as enhancing understanding of the current situation (Aydın, Sarıer & Uysal, 2012). In this regard, PISA results are not considered to be just a simple indicator of training needs. Rather, they can be used to achieve equality of opportunity in education and to identify the strengths and weaknesses of the education system. They also provide useful information about a country's economy (Choi, Calero & Escardibul, 2012). Turkey participated in PISA for the first time in 2003.

PISA focuses on a different subject area in each cycle. The first PISA study, conducted in 2000, emphasised reading skills; the second (in 2003) focused on mathematical literacy; and in 2006, the major domain of study was science and technology. In 2009, PISA re-examined the domain of reading literacy (OECD, 2010a). PISA's reading literacy framework is wider than the traditional concept of literacy. It incorporates problem-solving, application of knowledge and skills, analysis, and interpretation via logical inference (Anagün, 2011). Similarly, science literacy describes individuals who are able to use scientific methods to solve problems, who can establish cause-and-effect relationships using scientific principles, who are sensitive to social and environmental concerns, who understand the relationship between science, technology, society and the environment, and who are able to apply concepts, theories, laws and principles of science in everyday life (Choi, Lee, Shin, Kim & Krajcik, 2011). Cross-country comparisons of PISA results show a significant relationship

between reading comprehension and achievement in the domains of mathematics and science (Acar, 2012).

Acar and Öğretmen (2012) found that the PISA 2006 sciences test performances of Turkish students differed according to student and school levels. Using the same data, Anıl (2009) reported that the variable that best predicted students' science achievement and the most significant factor determining achievement was "time". Other factors predictive of science achievement were environment, education and attitudes, in that order. Similar results were obtained by Türkan, Üner and Alcı (2015), who showed that PISA 2012 mathematics test achievement scores differed significantly according to gender, age at first computer use, mother's work status, owning a computer at home, students having a room of their own and the number of the books at home. Anagün (2011) found that spending time on learning was the best predictive variable for the scientific literacy level of 15-year-old students in Turkey, followed by participation in experimental and inquiry-based learning activities in the teaching-learning process. The variables of self-concept and attitudes towards science had no effect on students' scientific literacy level. In PISA 2009, Arıcı and Altıntaş (2014) found that socio-economic background and pre-school education of more than one year significantly predicted students' levels of proficiency.

PISA evaluates both cognitive and affective aspects of students' science competencies. As well as the specific cognitive processes that characterise scientific inquiry, students' science competencies also include the capacity to use this knowledge effectively (Education Research and Development Department [ERDD], 2010).

PISA aims to assess the reading, scientific and mathematical literacy of students who are at the end of their mandatory education and will participate in modern society. The PISA 2009 instrument also collected data on students' socio-cultural backgrounds (OECD, 2010a). Knowledge about the affective and cognitive aspects of science-related competencies is important for individual and social development (Dobbins & Martens, 2012). Information about students' science performance at different times will tell us much about the science education system in that country (Minister of National Education [MONE], 2009). Better understanding the relationship between specific variables and learning outcomes will make a significant contribution to the education literature (Akyüz & Pala, 2010).

The present study draws on PISA 2009 data to analyse the relationship between the science achievement scores of 15-year-old students in Turkey and the following variables:

Gender, school type, geographic region, pre-school education, mother's education and father's education.

According to this purpose, answer was searched for the following sub-problems.

1. According to the results of PISA 2009 Turkey, do students' science achievement scores show significant difference according to gender variable?

2. According to the results of PISA 2009 Turkey, do students' science achievement scores show significant difference according to school type variable?

3. According to the results of PISA 2009 Turkey, do students' science achievement scores show significant differences according to variable of region type where they study?

4. According to the results of PISA 2009 Turkey, do students' science achievement scores show significant difference according to variable of having or not having pre-school education?

5. According to the results of PISA 2009 Turkey, do students' science achievement scores show significant difference according to variable of compulsory education of mother?

6. According to the results of PISA 2009 Turkey, do students' science achievement scores show significant difference according to variable of compulsory education of father?

Methodology

Research Design

Because the aim of the study was to determine whether the science achievement scores of 15-year-old students in Turkey were related to specific variables, survey methodology was employed (Gelbal, 2008; Karasar, 2009). A survey design provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (Creswell, 2014).

Universe and Sample

The study universe comprised all students in the 15 years age group. The sample comprised 4996 students who participated in the PISA 2009 survey; they were drawn from 12 statistical regional units, 56 provinces and 170 randomly selected schools stratified by school

type. Missing data were excluded from the analyses, which were performed on 4388 individuals.

Data Collection Tools

The PISA 2009 survey contained reading, mathematics and science achievement tests. There were 13 items in each group of achievement tests and a response time of 30 minutes was allowed for each group. For each participating country, 7 groups of reading skills items, 3 groups of mathematics skills items and 3 groups of science assessment items were included.

These groups of items were placed in 13 booklets according to a specific order. Each booklet contained 4 groups of items. Each student answered the items in one of the 13 booklets, which was randomly selected. Following the tests, students completed a survey that elicited information on the socio-demographic characteristics of students such as class, age and gender and their families' circumstances such as parents' education and employment status, family assets, and the number of books in the house (OECD, 2010a; MONE, 2010).

Data Analysis

Before analysis commenced, compliance of variables in PISA 2009 with univariate and multivariate normal distribution should be tested, along with assumptions about whether or not the data set has outliers Mardia's coefficients of skewness and kurtosis were used to assess univariate and multivariate normality and the assumption was shown to have been met (Yılmaz & Çelik, 2009).

The study used t-tests and one-way analysis of variance (ANOVA) for independent samples and Dunnett's C and Tukey HSD tests for multiple comparisons.

Results

In this section, results are presented separately for each of the variables examined.

Results of the t-test performed to determine whether students' science achievement scores varied by gender are shown in Table 1.

Table 1 t-Test Results of Students' Science Achievement Scores by Gender

Gender	N	$\overline{X}$	S	Sd	t	p
Girl	2142	464.9	76.53	4386	4.413	.00
Boy	2246	454.5	79.04			

$p < .05$

Students' science achievement scores differed significantly by gender [t(4386)=4.413, p<.05]. Girls' average science achievement scores ($\bar{X}$ = 464.909) were higher than boys' scores ($\bar{X}$ = 454,536). In other words, science achievement differed by gender and girl students were more successful.

Results of one-way analysis of variance related to students' science achievement scores and school type are shown in Table 2.

Table 2 Results of One-Way Analysis of Variance on Students' Science Achievement Scores by School Type

	N	$\bar{X}$	S		SS	Sd	MS	F	p	Differ.
1.Elementary School	85	341.1	53.7	Betw.	4153328	2	2076663	404.2	.00	1-2,
2.General High School	2489	484.2	76.4	Within	22529782	4385	5137.92			1-3, 2-3
3.Vocational High School	1814	431.3	65.38	Total	26683110	4387				

p< .05

Students' science achievement scores showed significant differences by school type [F(2-4385)=404.2, p<.05]. A Dunnett's C test was conducted to determine the source of the difference between the groups. The results showed a significant difference between three types of schools. High school students had the highest science achievement scores ($\bar{X}$ = 484.2); the average of elementary school students' science achievement scores ($\bar{X}$ = 341.1) was lower. In other words, scores of high school students were more positive than those of elementary school and vocational high school students.

Results of one-way analysis of variance on students' science achievement scores by geographic region are shown in Table 3.

Table 3 Results of One-Way Analysis of Variance on Students' Science Achievement Scores by Geographic Region

	N	$\overline{X}$	S		SS	Sd	MS	F	p	Difference
1.Istanbul	726	455.3	72.26	Betw.	985660.1	11	89605.46	15.26	.00	1-7, 1-11,
2.Western Marmara	218	470.5	70.29	With.	25697450	4376	5872.361			1-12, 2-11,
3.Aegean	550	468.2	76.53	Total	26683110	4387				2-12, 3-11,
4.Eastern Marmara	462	460.3	83.44							3-12, 4-11,
5.Western Anatolia	444	468.6	75.97							4-12, 5-11,
6.Mediterranean	569	466.9	76.10							5-12, 6-11,
7.Central Anatolia	268	478.5	77.75							6-12, 7-11,
8.WesternBlack Sea	332	457.9	74.75							7-12, 8-11,
9.EasternBlack Sea	196	470.3	85.20							8-12, 9-11,
10.North East Anatolia	111	460.7	93.60							9-12, 10-11,
11.Middle East Anatolia	173	426.0	69.00							10-12.
12.South East Anatolia	339	420.3	75.11							
Total	4388	459.6	77.99							

$p < .05$

Students' science achievement scores differed significantly according to the geographic region in which their schools were located [$F(11\text{-}4376)=15.26$, $p < .05$]. A Dunnett's C test was performed to determine the source of the difference between the groups. The results showed a difference in the averages of 21 different groups. The averages of students' science achievement scores were highest among students studying in Central Anatolia, Western Marmara and the Eastern Black Sea Region, while the lowest scores were found among those who were studying in South East Anatolia and the Middle East Anatolia Region. There was a significant difference between South East Anatolia, Middle East Anatolia and other regions and Central Anatolia and Istanbul. The average of students' science achievement scores in the Istanbul Region ($\overline{X}$ = 455.3) was lower than the average of students' science achievement scores in the Middle East Region ($\overline{X}$ = 478.5).

Results of a t-test performed to determine whether students' science achievement scores differ according to whether or not they had pre-school education are displayed in Table 4.

Table 4 t-Test Results of Students' Science Achievement Scores by Pre-School Education

Having or Not Having Pre-School Education	N	$\overline{X}$	S	sd	t	p
No	3063	446.2	72.752	3975	15.7	.00
1 year and less than 1 year	914	490.2	78.538			

p< .05

Students' science achievement scores differed significantly according to whether or not they had received pre-school education [t(3975)=15.7, p<.05]. The average scores of those with 1 year or less of pre-school education ($\overline{X}$ = 490.2) were higher than the average scores of those with no pre-school education ($\overline{X}$ = 446.2). This finding suggests that students with pre-school education were more successful in science.

Results of one-way analysis of variance on students' science achievement scores by mother's education are shown in Table 5.

Table 5 Results of One-way Analysis of Variance on Students' Science Achievement Scores by Mother's Education

	N	$\overline{X}$	S		SS	Sd	MS	F	P	Dif.
1.High School / Vocational / Technical School	1539	495.2	75.06	Betw.	3237166	4	809291.6	151.3	.00	1-2, 1-3, 1-4, 1-5, 2-5, 3-5, 4-5.
2.Apprenticeship Training	79	447.7	80.74	With.	23445944	4383	5349.3			
3.Elementary II. Step (Secondary)	1088	442.8	73.08	Total	26683110					
4.Elementary I. Level (Elementary)	1505	442.4	70.32							
5.Elementary not finished 1. Step	177	405.0	76.46							
Total	4388	459.6	77.99							

p< .05

Students' science achievement scores differed significantly according to their mother's highest level of education [F(4-4383)=139.0, p<.05]. The highest average scores occurred among students whose mothers had reached the education level of high school, vocational technical high school ($\overline{X}$ = 511.1) or Elementary Step II (Secondary) school ($\overline{X}$ = 453.3); the lowest average scores were found among students whose mothers had not completed Elementary Step I ($\overline{X}$ = 427.0) or had only completed apprenticeship training ($\overline{X}$ = 434.4).

The results of a multiple comparison test (Tukey HSD) show that science achievement scores increased with increasing level of mother's education.

Results of one-way analysis of variance on students' science achievement scores according to father's education are shown in Table 6.

Table 6 Results of One-Way Analysis of Variance on Students' Science Achievement Scores by Father's Education

	N	$\overline{X}$	S		SS	Sd	MS	F	P	Dif.
1.High School / Vocational/Technical School	827	511.1	73.49	Betw.	3003773	4	750943	139.0	.00	1-2,
2.Apprenticeship Training	27	434.4	70.23	With.	23679337	4383	5402.5			1-3,
3.Elementary II. Step (Secondary)	782	453.3	77.01	Total	26683110					1-4,
4. Elementary I. Level (Elementary)	2174	451.3	72.03							1-5,
5. Elementary not finished 1. Step	578	427.0	74.29							3-5,
Total	4388	459.6	77.99							4-5.

p< .05

Students' science achievement scores differed significantly according to the level of fathers' education [F(4-4383)=151.3, p< .05]. The average scores of students whose fathers had completed high school, vocational technical high school ($\overline{X}$ = 495.2) or apprenticeship training ($\overline{X}$ = 447.7) were the highest; the average scores of those whose fathers had not completed Elementary Step I ($\overline{X}$ = 405.0) or had only completed Elementary Level I (Elementary) ($\overline{X}$ = 442.4) were the lowest. The results of a multiple comparison test (Tukey HSD) show that science achievement scores increased with increasing level of education of fathers.

Conclusion and Discussion

Students' science achievement scores from PISA 2009 were analysed in relation to gender, school type, geographic region, pre-school education and parents' educational level.

When averages of science success in PISA 2009 were examined according to gender, female students' achievement scores differed significantly from those of male students. In Pisa 2006, the science achievement scores of male students in Hong Kong were nine points higher than those of female students. In most countries, girls have higher average achievement scores than boys. Similar results are reported elsewhere (Anıl, 2009; Aydoğdu, Şensoy & Yıldırım, 2008; Atalay Kabasakal & Kelecioğlu, 2012; Gelbal, 2008; Hong, et al, 2013;

MONE, 2009; Poyraz, Çağırgan Gülten & Bozkurt, 2013). In contrast, some studies show that male students are more successful than female students (Alacacı & Erbaş, 2010; H. Y.Atar, & B.Atar, 2012; Demir, Kılıç & Ünal 2010; Forgasz & Hıll, 2013; Ziya, 2008; Stoet & Geary, 2013; Uysal & Yenilmez, 2011; Yılmaz & Aztekin, 2012). In the present study, a possible explanation for differential success according to gender is that boys in a male-dominated society are more likely than girls to have access to technology, whereas girls assign greater importance to observation of details and cultural differences (Liu, 2006; Yip, Chiu & Ho, 2004; Sun, Bradley & Akers, 2012).

Students' science achievement scores differed significantly according to school type. The scores of 15-year-old students in vocational high schools and elementary schools were lower than those of students in public high schools. Other studies have reported similar findings (Alacacı & Erbaş, 2010; Berberoğlu & Kalender, 2005; Forgasz & Hıll, 2013). There are large differences in learning outcomes between types of schools in Turkey and in other OECD countries (ERDD, 2004). Such differences are inevitable when entry to some schools is determined by examination. A country should, however, provide equal training opportunities for all students (Berberoğlu & Kalender, 2005).

Students' science achievement scores differed significantly according to geographic region. Average scores were highest for students in Central Anatolia, Western Marmara and the Eastern Black Sea Region, and lowest for students in South East Anatolia and the Middle East Anatolia Region. This result shows that there are regional differences in Turkey in relation to educational quality and opportunity, with rural areas faring the worst. Similar results have been reported in other research (Aydın, Sarıer & Uysal, 2012; Aydıner, 2006; Berberoğlu & Kalender, 2005; Carnoldi, Giofre & Martini, 2013; Gedikoğlu, 2005; Forgasz & Hıll, 2013; Sarıer 2010; Sezer, Güner & Akkuş İspir 2012). These regional differences are likely to reflect unequal economic development, the preference of more experienced teachers to work in metropolitan rather than rural areas, and differential schooling rates (Aydın, Sarıer & Uysal, 2012; Carnoldi, Giofre & Martini, 2013; Çobanoğlu & Kasapoğlu, 2010; Forgasz & Hıll, 2013). To ensure equal educational opportunity, experienced teachers should be encouraged to work in rural areas and schooling rates should be increased, among other steps.

In Turkey, the science achievement scores of 15-year-old students differed significantly according to whether or not they had received pre-school education. Those with pre-school education had higher scores than those without pre-school education. Other studies have documented the positive impact of pre-school education on children's future success

(Anderson, 1994; Barnett, 2008; Melhuish et al, 2008; Rashid, Sanaullah, Iqbal & Khalid, 2013; Taiwo & Tyolo, 2002; Umek, Grgić & Pfifer, 2012; Uysal & Yenilmez, 2011). Researchers emphasise the need for education to begin at an early age to achieve educational success (Mantzicopoulos, Patrick & Sanarapungavani, 2013). Pre-school education has a positive effect on children's ability to solve problems in daily life as well as preparing them for primary school (Stylianides & Stylianides, 2011). Parents should be informed about the importance and benefits of pre-school education and encouraged to access it for their children (Genç Kuptepe, Kaya, & Kumtepe, 2009).

Students' science achievement scores differed significantly according to parents' level of education. Average science achievement scores increased with increasing level of parents' education. Higher levels of parental education are associated with higher occupational status and associated socio-economic levels. This has been well documented in other studies (Anıl, 2009; Berberoğlu, Celebi, Ozdemir, Uysal & Yayan, 2003; Casanova, García-Linares, Torre, & Carpio, 2005; Chen et al., 2012; Erturul, 2003; Keskin, & Sezgin, 2009; Koutsoulis, & Campbell, 2001; MONE; 2009; Poyraz, Çağırgan Gülten & Bozkurt, 2013; Uysal & Yenilmez, 2011; Yılmaz & Aztekin, 2012; Ziya, 2008). Families with a high level of education and high socio-economic status can provide better facilities and opportunities for children (Chen, et al., 2012; Gelbal, 2008).

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Uluslararası Öğrenci Değerlendirme Programı'nda (PISA 2009) Öğrencilerin Fen Başarılarının Çeşitli Değişkenler Açısından İncelenmesi

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Özet – Bu çalışmanın amacı PISA 2009 çalışmasında Türkiye'deki öğrencilerin fen başarısını etkileyen bazı değişkenler açısından incelenmiştir. Bu çalışmada, PISA 2009 öğrenci anket verisi kullanılmıştır. Araştırmanın evrenini, herhangi bir okula devam eden 15 yaşındaki Türk öğrenciler oluşturmaktadır. Örneklemini ise bu evrenden tabakalı örnekleme yoluyla seçilen 4996 öğrenci oluşturmaktadır. Analizlere başlanmadan önce kayıp veriler incelenmiş ve kayıp veriler analizden çıkartılmıştır. Analiz için son örneklem büyüklüğü 4388 öğrencidir. Çalışmanın amacına uygun olarak bağımsız t testi, varyans analizi (ANOVA) ve çoklu karşılaştırmalar kullanılmıştır. Araştırma sonuçlarına göre öğrencilerin fen başarısı ile okul türü, bölge, okul öncesi eğitimi alıp almama durumu, anne ve babanın eğitim seviyesi değişkenlerine göre anlamlı bir farkın olduğu belirlenmiştir. Fen başarı puanları, anne ve babanın eğitim seviyesi arttıkça artmaktadır. Okul öncesi eğitimi alan bireylerin almayanlara oranla, genel liselerde öğrenim görenlerin bireylerin diğer liselerde öğrenim gören bireylere oranla daha yüksek fen başarı puanlarının olduğu belirlenmiştir.

Anahtar Kelimeler: PISA 2009, fen eğitimi, fen başarı.

Genişletilmiş Türkçe Özet

Giriş

Uluslararası yapılan en büyük eğitim araştırmalarından birisi, Ekonomik İşbirliği ve Kalkınma Örgütünün (OECD) üç yıllık aralarla düzenlediği Uluslararası Öğrenci Değerlendirme Programı PISA (Programme for International Student Assessment)'dır. Bu proje, zorunlu eğitimin sonunda örgün eğitime devam eden 15 yaş grubundaki öğrencilerin günümüz bilgi toplumunda karşılaşabilecekleri durumlar karşısında sahip oldukları bilgi ve becerileri kullanabilme yeteneğini ölçmeyi amaçlayan bir tarama çalışmasıdır (Anagnostopoulou, Hatzinikita, Christidou & Dimopoulos, 2013; Cheng, 2012). PISA'yı

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değerlendirmek, mevcut durumun anlaşılmasının yanında ülkeler arası karşılaştırmalar yaparak, geleceğe dönük politikalar geliştirmek açısından önemlidir. Özellikle de vizyon geliştirme ve eğitimin planlanması süreçlerinde eğitimcilere ve politika üretenlere büyük katkı sağlamaktadır (Aydın, Sarıer & Uysal, 2012). Bu bağlamda PISA sonuçları, sadece basit bir eğitim göstergesi olarak düşünülmemekte, eğitimde fırsat eşitliği, eğitim sisteminin güçlü ve zayıf yönlerini belirlemek için de kullanılmaktadır. Bu sonuçlar aynı zamanda bir ülkenin ekonomisi hakkında da ipuçları vermektedir (Choi, Calero & Escardibul, 2012).

Toplum ve ülkelerin gelişmişlikleri üzerinde etkisi olduğu bilinen fen bilimleri ile ilgili bireylerin sahip oldukları duyuşsal ile bilişsel özelliklerin bilinmesi ve izlenmesi, bireylerin ve dolayısıyla ülkelerin geleceklerini şekillendirmeleri açısından önemlidir (Dobbins & Martens, 2012). Farklı zamanlarda öğrencilerin fen performanslarının belirlenmesi bize o ülkedeki fen eğitim sistemi hakkında bilgi verecektir (Ministry of National Education [MONE], 2009). Aynı zamanda farklı değişkenlerin öğrenme çıktıları ile ilişkilerinin belirlendiği çalışmaların yapılması eğitim literatürüne de anlamlı katkılar sağlamaktadır (Akyüz & Pala, 2010).

Bu araştırma, PISA 2009 kapsamında, Türkiye'de 15 yaş grubu öğrencilerin fen bilimleri başarılarını; cinsiyet, okul türü, bölge türü, bireyin okul öncesi eğitimi alıp almama durumu, annenin ve babanın eğitim düzeyi değişkenine göre manidar düzeyde farklılaşıp farklılaşmadığını incelemektir.

Yöntem

Araştırma, Türkiye'de 15 yaş grubu öğrencilerin fen bilimleri başarılarını etkileyen bazı faktörlere göre değişip değişmediğini belirlemek amacıyla yapılmaktadır. Bu nedenle araştırmada genel tarama modeli kullanılmıştır (Gelbal, 2008; Karasar, 2009). Tarama modelinde bireylerin eğilimi, tutumu, görüşleri gibi etkenler var olan haliyle sayısallaştırıldığı için araştırmada bu model kullanılmıştır (Creswell, 2014).

Evren ve Örneklem

Araştırmanın evreni Türkiye'deki tüm 15 yaş grubundaki öğrencilerdir. Örneklemi ise Türkiyede tabakalandırılarak seçkisiz yöntemle belirlenen toplam 170 okuldan 4996 öğrencidir. Analizlere başlanmadan önce kayıp veriler analiz dışı bırakılmış ve analizler 4388 kişi üzerinde yürütülmüştür.

Veri Toplama Aracı

PISA 2009'da öğrenciler okuma becerileri, Matematik ve Fen başarı testlerini yanıtlamışlardır. Ayrıca PISA 2009'da öğrencilerin demografik özelliklerine ait bilgiler de yer almaktadır (Organisation for Economic Co-operation and Development [OECD], 2010a; Ministry of National Education [MONE], 2010).

Veri Analizi

Araştırmanın amacına uygun olarak ilişkisiz örneklemler için t testi ve tek yönlü varyans analizi (ANOVA) ve çoklu karşılaştırmalar için Dunnet C ve Tukey HSD testleri kullanılmıştır.

Bulgular ve Yorum

PISA 2009 fen puanları cinsiyet değişkenine göre analiz edildiğinde, kızların erkeklere göre fen puanlarının manidar düzeyde yüksek olduğu tespit edilmiştir. Bu durum kızların erkeklerden göre daha başarılı olduğunu göstermektedir.

Öğrencilerin fen başarı puanları ile öğrenim gördükleri okul türü değişkeni arasında manidar düzeyde bir farklılaşma varıdır. Buna göre, genel lise en yüksek, meslek liseleri ile ilköğretim öğrencilerinin fen başarı puanı en düşüktür.

Öğrencilerin fen başarı puanları ile öğrenim gördükleri bölge değişkeni arasında manidar farklılıklar vardır. Orta Anadolu, Batı Marmara ve Doğu Karadeniz Bölgeleri en yüksek iken, Güneydoğu Anadolu ve Ortadoğu Anadolu Bölgeleri fen başarı puanı açısından en düşük ortalamaya sahiptir. Bu durum bölgeler arasında eğitimin farklılaştığının bir göstergesi olup eğitimde fırsat eşitliği ilkesi ile ters düşmektedir.

Fen başarısının okul öncesi eğitimi alıp almama durumuna göre manidar düzeyde farklılık göstermektedir. Okul öncesi eğitimi alan öğrenciler almayanlara oranla daha başarılıdır.

Öğrencilerin fen puanlarının annenin ve babanın eğitim durumu değişkenine göre manidar düzeyde farklılık gösterdiği belirlenmiştir. Bu bulguya göre anne ve babanın eğitim düzeyi arttıkça çocukların da fen başarı puanın arttığı görülmektedir.

Sonuç ve Öneriler

Ülkelerin birçoğunda kızlar erkeklere göre daha yüksek bir ortalama başarı puanına sahiptir. Bu durumu destekler nitelikte benzer çalışmalar da yer almaktadır (Gelbal, 2008; Hong ve diğer, 2013; MONE, 2009). Bunun aksine bazı çalışmalar erkek öğrencilerin kız öğrencilere oranla daha başarılı olduğunu göstermektedir (Forgasz & Hıll, 2013; Stoet &

Geary, 2013; Yılmaz & Aztekin, 2012). Cinsiyet değişkenine göre başarının farklılaşma sebebi olarak; derste işlenilen bazı konularda erkeklerin eğilimli olması bazılarında ise kızların o konuya eğilimli olması, toplumda baskın olan cinsiyet grubu, erkeklerin kızlara oranla teknolojiye daha yatkın olması, kızların daha çok ayrıntı ve gözleme önem vermeleri, kültürlerin farklı olması gösterilebilir (Liu, 2006; Sun, Bradley & Akers, 2012).

Okul türü değişkenine bakıldığında genel lisede öğrenim gören öğrencilerin meslek lisesi ve ilköğretimdeki öğrencilere oranla daha yüksek fen başarı puanlarının olduğu görülmektedir. Bu durum benzer çalışmalarda da ifade edilmektedir (Alacacı & Erbaş, 2010; Forgasz & Hıll, 2013). OECD ülkeleri arasında Okul türü ile fen başarı puanları arasındaki farklılaşmanın Türkiye'de dikkate değer olduğu görülmektedir (Education Research and Development Department [ERDD], 2004). Öğrencilerin Türkiye'deki okul türlerine sınavla yerleşmesinin sonucu olarak fen puan ortalamaları da farklılaşmaktadır. Sosyal bir ülkede eğitim olanaklarının eşit bir şekilde olması ve bunlardan herkesin eşit şekilde ve aynı ölçüde yararlanması gerekmektedir (Berberoğlu & Kalender, 2005).

Pisa 2009 verilerinde fen başarı puanları ile öğrencilerin öğrenim gördükleri bölge değişkenleri arasında farkın çıkması, Türkiye'de eğitim imkânları ve kalitesi açısından bölgesel farklılıkların bulunduğunu ve kırsal alanlarda eğitimin niteliğinin düşük olduğunu göstermektedir. Kırsal bögelerde yaşayan bireylerin başarı puanları kentsel bölgelerde yaşayan bireylerin başarı puanlarına oranla düşük olduğunu gösteren çalışmalar da yer almaktadır (Carnoldi, Giofre & Martini, 2013; Forgasz & Hıll, 2013).

Okul öncesi eğitimi alan öğrencilerin fen başarı puanı yüksek çıkmıştır. Bu duruma benzer çalışmalar da mevcuttur (Rashid, Sanaullah, Iqbal & Khalid, 2013; Umek, Grgić & Pfifer, 2012). Küçük yaşlarda eğitime başlanması bir başka ifade ile bireyin okul öncesi eğitim alması, onun yaşamının ilerleyen süreçlerinde daha nitelikli birey haline gelmesini desteklemektedir (Mantzicopoulos, Patrick & Sanarapungavani, 2013).

Anne ve baba eğitim seviyesindeki artış mesleki statünün artmasına, mesleki statünün artmasıyla sosyo ekonomik seviyenin artmasına neden olmaktadır (Chen, Lin, Wang, Lin & Kao, 2012; Koutsoulis & Campbell, 2001). Eğitim seviyesi ve sosyo ekonomik seviyesi yüksek olan aileler, çocuklarına daha iyi imkan ve fırsatlar sağlayabilmektedirler (Chen, et al., 2012; Gelbal, 2008).