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The Position of Turkey among OECD Member and Candidate Countries according to PISA 2009 Results

Tülin ACAR[a]
Parantez Education Research Consultancy Center

Abstract

The aim of the study is to determine the status of Turkey among OECD (Organisation for Economic Co-operation and Development) members and candidate countries through cluster and discriminant analyses according to PISA (Programme for International Student Assessment) 2009 results. The study includes 475460 fifteen year-old students from 65 countries participating in the PISA Project in 2009. According to the cluster analyses , in the first cluster, 13 countries, 9 of which are candidate countries; in the second cluster 30 countries, 5 of which are candidate countries; in the third cluster 10 countries, 5 of which are candidate countries and in the fourth cluster 12 countries, all of which are candidate countries were clustered. Turkey was clustered in the first cluster and along with Turkey, Bulgaria, Chile, Colombia, Israel, Jordan, Mexico, Dubai (UAE), Romania, Serbia, Thailand, Trinidad, and Tobago were clustered in the first cluster, too. According to the discriminant analyses, 96,9% of original grouped cases correctly classified.

Key Words

2009-PISA, OECD Countries, Cluster Analysis, Discriminant Analysis.

In today's world, in which the notion of globalization is predominant on areas such as education, economy, military, and technology, many organizations have been established such as European Union (EU), Organisation for Economic Co-operation and Development (OECD), United Nations (UN), North Atlantic Treaty Organization (NATO), International Monetary Fund (IMF), etc. It is seen that these organizations, which were established in different times, share common purposes. For instance, EU and OECD have a common characteristic which is "economic development". Whereas Turkey is one of the founders of OECD, she is still an EU candidate. It is possible to encounter many national and international declarations, reports, and academic studies in which Turkey in the EU accession process is compared to EU countries in terms of socio-economic parameters (Ada Altun, 2011; Erkekoğlu, 2007; Şahin & Hamarat, 2002; Yılmaz & Kaya, 2005). In these studies, development indicators of countries are examined and compared frequently. Whereas the level of education in which variables such as the rate of literacy, schooling, the schooling of girls are discussed with priority in some studies, others regard macro-economic variables such as gross national product, rate of inflation, real growth, purchasing power, etc to be the indicators of development. United Nations Development program, by using Human Development index as an indicator

a **Tülin ACAR, PhD.**, is an Educational Measurement and Evaluation specialist. Research interests include hierarchical linear models, differential item functioning, psychometric properties of tests, educational statistics, multivariate statistical analysis. Correspondence: Tülin ACAR, Measurment and Evaluation specialist, Parantez Education Research Publisher, Selanik Street No: 46/4 Kızılay-Çankaya, Ankara/TURKEY. E-mail:totbicer@gmail.com Phone: +90 312 425 1995 Fax: +90 312 425 1995.

of development, presented a common notion to researchers (Erkekoğlu). With Human Development index, countries are categorized as high, medium, and low human development depending on three variables that are income, education and health (Morse, 2003).

Mankiw et al. (1992) use the ratio of the population at the age of 15-19 enrolled in secondary education to the active population as an indicator of human development (as cited in Dura, Atik, & Türker, 2004). To what extent the population at the age of 15-19 uses knowledge in various areas, the level of access to knowledge, reasoning, problem-solving etc. skills are important for the countries in this regard. In this context, PISA (Programme for International Student Assessment) project, whereby the skills of 15-years-old students in science, mathematics, and reading are assessed in OECD countries, prove an important source of information regarding the determination of the shortcomings in national education systems and for their development.

With the PISA project, it is aimed to determine not only to what extent 15-years-old students who are at the end of the compulsory education process remember what they have learned but also their ability to apply what they have learned to their lives outside the school, to what extent they are able to utilize their knowledge and skills in order to understand new situations they would encounter, to solve problems, to make estimations on issues which they do not have sufficient knowledge and their utilization of reasoning (Education Research and Development Department/Eğitim Araştırma Geliştirme Dairesi [EARGED], 2011b). In PISA exams, along with Science, Mathematics, and Reading Competency areas, student and school surveys are also applied in order to collect information about some other indicators which are considered to be related to student performance (social, cultural, economic, and educational indicators) (Organisation for Economic Co-operation and Development [OECD], 2009).

Turkey participated in the project, which is being applied in three-year periods, in 2003 for the first time. The latest exam was held in 2009. The statuses of countries participant in PISA in terms of membership and candidacy to OECD are given.

It is seen that in 2009, PISA project was applied to totally 65 countries, 31 of which are OECD members. Among 65 participant countries, Turkey ranked 43rd in 2nd level in terms of the level of learning in Science and Mathematics, and 41st in 2nd level in terms of the level of Reading Competency (Özenç & Arslanhan, 2010). According to these findings, it can be argued that Turkey's rank is not a desired one. According to PISA-2009 results, Finland ranked 1st in terms of Reading Competency and Science whereas Hong Kong-China ranked 1st in Mathematics (Özenç & Arslanhan).

Purpose

Today, the subject of the majority of the research conducted on PISA results consists of the shortcomings observed in the system of education, comparison of Turkey to other countries in terms of the level of success, and the reasons for both successes and failures (Anıl, 2009; Aydın, Erdağ, & Taş; 2011; Berberoğlu & Kalender, 2005; Çelen, Çelik, & Seferoğlu, 2011; Çobanoğlu & Kasapoğlu, 2010; Güzel İş, 2006; Özenç & Arslanhan, 2010; Savran, 2004). This study, however, investigates the position of Turkey among OECD members and candidate countries according to PISA 2009 results through clustering and discriminant analyzes. It also aims at determining the common variables in the classification of countries that stand together with Turkey.

Method

Universe and Sampling

This study is a descriptive research which determines Turkey's position among OECD members and candidate countries. The universe of research consists of totally 475.460 15-years-old students from 65 countries that participated in PISA project in 2009. In other words, sampling did not take place since the study included all the units within the universe.

Instrument

No data collection instruments were used for this research. However, certain measurement instruments including various question types such as multiple-choice, mixed multiple-choice, open-ended, and closed are employed in PISA project. With these measurement instruments, data on subject areas such as Mathematical literacy, Sci-

ence literacy, Reading Skills as well as student motivation, students' views about themselves, their ways of learning, school atmosphere, and about their families are collected (EARGED, 2011b). It is stated in PISA 2009 National Memorandum that great efforts were made in order to ensure the validity and reliability of measurement instruments for all countries and to minimize cultural and linguistic differences and thus findings obtained through PISA have the highest validity and reliability (EARGED, 2011a).

Process

Data of the research were obtained from PISA-2009 PISA's official webpage. Variables used in the research are Mathematics, Science, and Reading Competency scores. The first one of those scores which were estimated in five was processed. Firstly, the average of Mathematics, Science, and Reading Competency scores of totally 475.460 students participated in PISA 2009 from 65 countries were calculated according to countries. In this way, Mathematics, Science, and Reading Competency scores of each country were obtained. Average Mathematics, Science and Reading Competency scores of countries were used during the operations of clustering and discriminant analyzes.

Firstly the clustering analysis was applied to the data. *Clustering Analysis* is the collection of methods that help the categorization of those units, variables, or units and variables in X data matrix, the natural classification of which is unknown, into sub-sets (groups, classes) similar to each other (Tatlıdil, 1992). That is, the clustering analysis is the method of categorizing *units, variables,* or *units and variables* within a data stack about the structures of which there is no certain information into sub-sets (classes, groups) (Özdamar, 2002).

Clustering analysis was performed over the sets via the method of non-hierarchic K-means. The analysis assumed 2 and 3 sets; however, it was seen that distance values did not present a normal distribution. The results of Kolmogrov-Smirnov Test conducted to determine whether the distance values present a normal distribution when the analysis was carried out with 4 sets are indicated in this research.

The assumption of the normality of variables in multi-variable statistical analyses is not very important in clustering analysis and the normality of distance values seems adequate (Tatlıdil, 1992, p. 252). Therefore, when the set number is determined as 4, it is seen that distance values present a normal distribution (p>0.05).

At the second step, discriminant analysis was performed over the same data. *Discriminant Analysis* is a method that allows the categorization of variables within X data set into two or more real groups and generates functions that enable the assignment of units to their proper real groups and classes most suitably by treating p amount of characteristics of such units (Özdamar, 2002).

In the clustering analysis, the result of Box's M-test was evaluated for the assumption of homogeneity in the discriminant analysis of the average Mathematics and Science test scores and is indicated.

Following Box's M test, it was seen that the assumption of the non-homogeneity of covariance matrices was satisfied (p>0.05).

Findings

Findings of Clustering Analysis

The distribution of 65 countries which are categorized under 4 sets according to the estimated Reading Competency, Mathematics, and Science scores obtained from PISA 2009 is indicated in this research.

According to the findings, the 1st class consisted of 13 countries 9 of which were OECD candidates, the 2nd class consisted of 30 countries 5 which were OECD candidates, the 3rd class consisted of 10 countries 5 of which were OECD candidates and the 4th class consisted of 12 all of which were OECD candidates. Turkey was categorized under the 1st class in which Bulgaria, Chile, Columbia, Dubai, Israel, Jordan, Mexico, Romania, Serbia, Thailand, Trinidad & Tobago, and Uruguay were included. The results of the investigation concerning whether the variables of Reading Competency, Mathematics, and Science scores were important in the determination of classes are presented.

According to ANOVA results, it is observed that Reading Competency, Mathematics, and Science variables are significant in the formation of the classes (p<0.05).

Findings of Discriminant Analysis

Wilks' Lambda and Chi-Square test statistics regarding its success on assigning countries to the groups, and whether the discriminant function is meaningful are presented.

According to the results, it is seen on the Table that the success of the discriminant function regarding the assignment of countries to the groups is significant for the first two functions (p<0.05). Standardized coefficients belonging to the discriminant function are given in this research.

The Table 7 shows that three functions are generated and the canonic correlation of the first function is 0,962. It can be said that the 1st function is highly effective in categorizing countries into groups. The results of the investigation concerning whether the average scores of Mathematics, Science, and Reading Competency variables differ among four groups are presented.

In the clustering analysis, it was seen that Reading Competency, Mathematics, and Science variables were determinant in the categorization of 65 countries that participated in PISA 2009 assessment into four sets (p<0.05). The fact that Wilks' Lambda values approximates to zero implies that these variables are highly effective in terms of categorization (Çokluk, Şekercioğlu, & Büyüköztürk, 2010). Wilks' Lambda values of Reading Competency, Mathematics, and Science variables were also observed to be close to zero. The results of discriminant analysis regarding the correctness of categorization are presented in this research.

It was observed that 2 of the countries which compose the 2nd class did not belong to this class but were estimated in 1st and 3rd classes. Generally, when Science, Reading Competency and Mathematics PISA-2009 test scores pertaining to the countries that are categorized into four classes are considered, it is seen that discriminant analysis performed a correct categorization with a rate of 96.9%. The findings regarding the average scores and standard deviations pertaining to the performance of countries which belong to the categorized classes in PISA-2009 Mathematics, Reading Competency and Science tests are given.

It was observed that thirteen countries within the 1st class, to which Turkey also belonged, obtained an average score of 425.66 from 2009-PISA Mathematics test, 434.69 from Science test, and 437.04 from Reading Competency test. However, Turkey was observed to have higher average scores than those of other countries which shared the same class (Mathematics 446.91, Reading Competency 466.42, and Science 455.45).

When the average scores obtained by countries within various classes from 2009-PISA Mathematics, Reading Competency, and Science tests are observed, it is seen that the most successful class was the 3rd whereas the least successful was the 4th. The countries within the 1st class, to which Turkey belonged, ranked third in terms of the average scores obtained from Mathematics, Reading Competency, and Science tests. In other words, their averages in terms of test success are observed to be low.

Discussion

It is noticeable that the 3rd class, which is the most successful one in terms of results obtained from PISA-2009 Mathematics, Reading Competency, and Science tests, contained those countries such as Finland, Hong Kong-China, South Korea, and Japan. The common characteristic of the countries within this class is their completion of curriculum modifications in line with the principles of a knowledge-based economy (Kalkan, 2008). Besides, these countries are observed to have equality of opportunity, competent instructors, guidance for students according to their skills in their systems of education, a social culture and understanding that values literacy, etc (Çobanoğlu & Kasapoğlu, 2010). Apparently, the quality of the system of education of a given country is directly proportional to economic indicators. Turanlı and Deniz (2008) suggested that the differences observed during the classification of 34 countries including Turkey were generally due to the population and to the ratio of the budget allocated to education from GDP. Therefore, Turkey should catch up EU average in terms of economic indicators in order to display success in international projects such as PISA and TIMSS. Yılmaz and Kaya (2005) found out that Turkey and Romania belong to the same class in terms of those indicators such as inflation rate, the ratio of budget balance to gross domestic product, the ratio of total public debt to gross domestic product, long-term interest rate and gross domestic product per capita. This study also observed Turkey and Romania to belong to the same class. Stud-

ies in which economic indicators are discussed are also evaluated along with the categorization study based on 2009-PISA results; and it is also observed in other studies that Turkey is grouped together with other countries belonging to the same class in this study. Erkekoğlu (2007), in her study, put forth that Turkey fell under the same class with Lithuania, Latvia, Poland, Bulgaria, and Romania as a result of a clustering analysis applied to 28 countries in terms of 39 variables such as demographic, educational, health, informational, communicational as well as economic indicators. According to the PISA-2009 results, both in this study and Erkekoğlu's study, Bulgaria and Turkey belong to the same class. Tatlıdil and Cinel (1997), in their study conducted on 12 variables such as life expectations, the rate of literacy among adults, GDP, population growth rate, natality per woman, the rate of infant mortality, inflation rate, the share of agriculture within GDP, and the share of exports within domestic production, found out that Turkey belongs to the same class with Bulgaria, Czech Republic, Hungaria, Malta, Poland, and Romania. When PISA-2009 results are compared to the study of Tatlıdil and Cinel that Turkey belongs to the same class with Bulgaria and Romania is common.

Recommendation

It is possible to investigate those educational indicators determinant in the formation of classes and the common characteristics of the systems of education of the countries belonging to same groups after the classification conducted via clustering and discriminant analyses within the scope of this study. Along with that, it is possible to compare and contrast the future conditions of the countries within the class to which Turkey belongs and other countries as well as an evaluation at national level by using national and international educational indicators and the outcomes of techniques such as clustering and discriminant analyses.

References/Kaynakça

Ada Altun, A. (2011). Kümeleme analizi ile AB ülkeleri ve Türkiye'nin sürdürülebilir kalkınma açısından değerlendirilmesi. *Dumlupınar Üniversitesi Sosyal Bilimler Dergisi*, *29*, 319-332.

Anıl, D. (2009). Uluslararası öğrenci başarılarını değerlendirme programı (PISA)'nda Türkiye'deki öğrencilerin fen bilimleri başarılarını etkileyen faktörler. *Eğitim ve Bilim, 34* (152), 87–100.

Aydın, A., Erdağ, Ç. ve Taş, N. (2011). 2003–2006 PISA okuma becerileri sonuçlarının karşılaştırmalı olarak değerlendirilmesi: en başarılı beş ülke ve Türkiye. *Kuram ve Uygulamada Eğitim Bilimleri Dergisi, 11*, 665-673.

Berberoğlu, G. ve Kalender, İ. (2005). Öğrenci Başarısının yıllara, okul türlerine, bölgelere göre incelenmesi: ÖSS ve PISA analizi. *Eğitim Bilimleri ve Uygulama*, *4* (7), 21-35.

Çelen, F. K., Çelik, A. ve Seferoğlu, S. (2011). Türk eğitim sistemi ve PISA sonuçları. *Akademik Bilişim 2011,* 1-9, İnönü Üniversitesi, Malatya. Retrieved June 10, 2011 from http://yunus.hacettepe.edu.tr/~sadi/yayin/AB11_Celen-Celik_Seferoglu_PISA-Sonuclari.pdf

Çobanoğlu, R. ve Kasapoğlu, K. (2010). PISA'da Fin başarısının nedenleri ve nasılları. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *39*, 121-131.

Çokluk, Ö., Şekercioğlu, G. ve Büyüköztürk, Ş. (2010). *Çok değişkenli istatistik SPSS ve LISREL uygulamaları.* Ankara: Pegem Akademi Yayınları.

Dura, C., Atik, H. ve Türker, O. (2004). Beşeri sermaye açısından Türkiye'nin Avrupa birliği karşısındaki kalkınma seviyesi. *3. Bilgi Ekonomi ve Yönetim Kongresi* içinde (s. 13-20). Eskişehir: Osmangazi Üniversitesi, İktisadi ve İdari Bilimler Fakültesi.

Eğitim Araştırma Geliştirme Dairesi [EARGED] (2011a). *Türkiye'de PISA uygulamaları.* Retrieved June 10, 2011 from http://earged.meb.gov.tr/arasayfa.php?g=83.

Eğitim Araştırma Geliştirme Dairesi [EARGED] (2011b). *PISA 2009 ulusal ön rapor*. Retrieved 10 June 2011 from http://earged.meb.gov.tr/dosyalar/pisa/pisa2009rapor.pdf

Erkekoğlu, H. (2007). AB'ye tam üyelik sürecinde Türkiye'nin üye ülkeler karsısındaki göreli gelişme düzeyi: çok değişkenli istatistiksel bir analiz. *Kocaeli Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 14* (2), 28-50.

Güzel İş, Ç.(2006). *A cross-cultural comparison of the impact of human and physical resource allocations on students' mathematical literacy skills in the programme for international student assessment (PISA) 2003*. Unpublished doctoral dissertation, Middle East Technical University, Ankara.

Kalkan, M. (2008). *Eğitim harcamaları ile öğrenci başarısı arasındaki ilişki*. Retrieved June 10, 2011 from http://mukerremkalkan.tr.gg/E%26%23286%3B%26%23304%3BT%26%23304%3BM-HARCAMALARI-%26%23304%3BLE--Oe-%26%23286%3BRENC%26%23304%3B-BA%26%23350%3BARISI-ARASINDAK%26%23304%3B-%26%23304%3BL%26%23304%3B%26%23350%3BK%26%23304%3B.htm

Morse, S. (2003). Greening the United nations' human development index? *Sustainable Development Sust. Dev. 11*, 183–198.

Organisation for Economic Co-operation and Development [OECD]. (2009). *Database – PISA 2009*. Retrieved 10 June 2011 from www.oecd.org/edu/pisa/2009

Özdamar, K. (2002). *Paket programlar ile istatistiksel veri analizi 2.* Eskişehir: ETAM A.Ş. Matbaa Tesisleri, Kaan Kitapevi

Özenç, B. ve Arslanhan, S. (2010). PISA 2009 sonuçlarına ilişkin bir değerlendirme. *Türkiye Ekonomi Platformu Araştırma Vakfı Değerlendirme Notu.* Retrieved 10 June 2011 from http://www.tepav.org.tr/upload/files/1292255907-8.PISA_2009_Sonuclarina_Iliskin_Bir_Degerlendirme.pdf

Savran, N. Z. (2004). PISA-projesinin Türk eğitim sistemi açısından değerlendirilmesi. *Gazi Üniversitesi Türk Eğitim Bilimleri Dergisi*, *4* (2) 397-412.

Şahin, M. ve Hamarat, B. (2002). *G10 - Avrupa birliği ve OECD ülkelerinin sosyo-ekonomik benzerliklerinin fuzzy kümeleme analizi ile belirlenmesi*. ODTÜ Uluslararası Ekonomi Kongresi VI. 1-19, Ankara. Retrieved 10 June 2011 from http://www.econ.utah.edu/~ehrbar/erc2002/pdf/P397.pdf

Tatlıdil, H. (1992). *Uygulamalı çok değişkenli istatistiksel analiz.* Ankara: Cem Web Ofset Ltd. Şti.

Tatlıdil, H. ve O. Cinel (1997), Türkiye'nin AT üyeliği ve beşeri kalkınma durumu. *Hazine Dergisi, 6*, 53-68. http://www.econturk.org/hazine29.pdf adresinden 10 Haziran 2011 tarihinde edinilmiştir.

Turanlı, M. ve Deniz, Ö. (2008). Ülkelerin çok boyutlu ölçekleme analizi ile karşılaştırılması. *Marmara Üniversitesi Sosyal Bilimler Enstitüsü Öneri Dergisi*, *29*, 187-192.

Yılmaz Ö ve Kaya V. (2005). Genişleme sürecindeki Avrupa birliği: Ekonomik performansa dayalı kümeleme analizi, *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 5* (1), 63-376.