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The Review of Variables Related to Problem Solving Skills in PISA 2003-2012 of Turkey *

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Abstract

This study is aimed to review the results of problem solving skills test in PISA of Turkey in terms of gender, curriculum and types of school. The data was analyzed by the means of document analysis method in this study which has a qualitative descriptive research design. The reports published by OECD and MEB were used as data collection instruments, and also articles, master thesis and dissertations and reports, which have open access and are published in national and foreign literature in 2004-2014, were used to interpret in these data in the study. According to findings, Turkey has been located at the proficiency level 2 in both PISA 2003 and 2012 in terms of mathematical literacy, and moreover there is a difference between the score point and ranking of success but any development has been not seen on proficiency level. The findings in the study are evaluated according to gender, types of school and curriculum published in 1995 and 2004. According to the results of the study, both PISA 2003 and 2012 is seen to have difference in score and ranking, there is no difference at the proficiency levels. When the results is analyzed in terms of variables of the study, the most successful school type in PISA 2003 is science high school while the students from vocational high school are more successful in problem solving than the other field in PISA 2012. Male students have been more successful than female students in both PISA 2003 and 2012, but it has been showed that there is no a significant difference statistically between them.

Keywords: PISA, problem solving skills, curriculum.

PISA 2003 ve 2012 Problem Çözme Becerileri Sonuçlarının Türkiye Açısından İncelenmesi

Öz

Bu çalışmada, 2003 ve 2012 yılı PISA uygulamalarının Türkiye açısından problem çözme becerileri sonuçlarının cinsiyet, eğitim programı ve okul türüne göre değerlendirilmesi amaçlanmaktadır. Bu amaç doğrultusunda nitel bir yapıya sahip bu araştırmada doküman incelemesi yöntemi kullanılarak veriler analiz edilmiştir. Araştırma içerisinde OECD ve MEB tarafından yayımlanan raporlar veri toplama araçları olarak kullanılmış ve verilerin yorumlanmasında bunlara ek olarak 2004 ve 2014 yılları arasında yayımlanan tam erişime açık, yurt içi ve yurt dışı literatürde yer alan

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makale, tez ve raporlar kullanılmıştır. Elde edilen verilere göre Türkiye'nin her iki yıla ait uygulama arasında alınan başarı puanı ve başarı sıralamasında pozitif yönde farklılık bulunmakla birlikte bulunduğu yeterlik düzeyi açısından herhangi bir değişiklik görülmemektedir. Araştırmada elde edilen bulgular cinsiyet, okul türü ve 1995 ve 2004 yılı eğitim programlarına göre değerlendirilmiştir. Araştırmadan elde edilen sonuçlara göre her iki yıla ait uygulama arasında alınan başarı puanı ve başarı sıralamasında bir farklılık bulunmakla birlikte bulunduğu yeterlik düzeyi açısından herhangi bir değişiklik görülmemektedir. Araştırma değişkenleri açısından sonuçlar incelendiğinde, PISA 2003'te en fazla başarı gösteren okul türü fen liseleri olurken; PISA 2012 problem çözme becerileri sınav sonuçlarına göre diğer alanlara oranla meslek liselerinden katılan öğrencilerin bu alanda daha başarılı oldukları görülmüştür. PISA 2003 ve 2012'de problem çözme becerilerinde erkek öğrenciler kız öğrencilere göre daha başarılıdır, fakat aralarında istatistiksel açıdan anlamlı bir fark olmadığı görülmektedir.

Anahtar kelimeler: PISA, problem çözme becerileri, eğitim programı.

1. INTRODUCTION

Programme for International Student Assessment (PISA) is one of the most comprehensive educational research conducted by Organization for Economic Co-Operation and Development-OECD. PISA is aimed to measure 15-year-old students, continuing to the formal education at the end of compulsory education, mathematical, scientific and reading skill literacy, also their knowledge in and out of school life (Altun, Aydın, Uzel & Akkaya, 2012). When they encounter a new situation, it is aimed to assess their understanding, problem solving, and prediction and judgement skills. PISA defines "literacy" as improving students' knowledge and potential; participating into the society in a more effective way; finding, using, accepting and assessing written resources to contribute to the society effectively (Stacey, 2011; Thomson, 2013).

PISA consists of three sub-fields basically. These sub-fields are mathematical literacy, scientific literacy and reading skill literacy. PISA focuses on one of the contents which are mathematical literacy, reading skills and science literacy every year. PISA assess students' problem solving skills in the year which is focused on mathematical literacy. Problem solving is defined as cognitive skills which are used to solve the problems relating to real life where individuals could not solve the problems easily and there is no sufficient knowledge to assess the skills of certain areas such as literacy, knowledge areas and curriculum (OECD, 2003; Pala, 2008). Students are faced with real life problems in mathematical literacy assessment of PISA. Students are expected to identify mathematical analysis skills and aspects including in research, some features and to use some mathematical proficiencies toward solving problems (Rosen & Mosharraf, 2014).

Problem solving is generally accepted as a developed thinking skill. Problem solving is consisted of different thinking processes (Codina, Canadas & Castro, 2015; Fischer, Greiff, Wüstenber, Fleischer, Buchwald, & Funke, 2015). Problem solving is a method which requires conceptual background (Van Merrienboer, 2013). Problem solving is to find a solution or make a decision someone use prior knowledge (Çoban, 2014). According to Polya (1973), problem solving has four stages like i) understanding the problem, ii) creating a plan, iii) carrying out the plan and iv) testing and looking back plan (Sukoriyanto, Nusantara, Subanji & Chandra, 2016). PISA focuses on three type of problem solving. They are respectively deciding, system analysis and design and solve a problem. Students are posed to different degree of questions in problem solving as well as other areas in PISA.

There are so many studies related to PISA but there is few about PISA problem solving skills in the related literature. Sealy, Perry and DeNicola (2016) analyzed the relationships PISA success and job satisfaction between the people from participating country. In their study they stated that Some countries like Singapore, Australia,

Spain, Latvia and Portugal had significant and moderate relationship between PISA success and global and local job satisfaction. Another study have concluded that use of creativity or thinking creatively in mathematics lesson have developed problem solving skills in daily life. Use of the tasks in the mathematics lesson like PISA problem solving questions have identified to develop students mathematics anxiety and encourage students to be more creatively in mathematics (Novita & Putra, 2016). While F. Buchberger and I. Buchberger (2003) and Pehkonen (2007) was analyzing problem solving skills in mathematics education of students in Finland, Yang (2011) studied comparatively problem solving skill of students living in South Korea and USA. Isoda (2010) included classroom practices about mathematics in the study investigating the reasons of Japan's success in PISA. Tambychick and Maeerah (2010), Tshering and Prain (2011) compared the different OECD countries' PISA results with each other in terms of many variables in their studies.

PISA has many features which are to direct policy; to bring literacy concept to light; to deal with lifelong learning and to being implemented regularly and comprehensively (Thomson, 2013; Weiss & Müller, 2014). The number of participating countries in PISA have been increasing year by year. 65 countries, including 34 OECD members, participated in PISA 2012 (Bortoli, Thomson, Nicholas, Hillman & Buckley, 2010).

It has been thought to be important to examine this study because of limitation of the literature. Moreover comparison of PISA 2003 and 2012 mathematical literacy results would provide assessment of curriculum, which was renewed in 2004, in terms of qualifications about problem solving skill at international level. PISA 2003 is included the test which is to assess problem solving skills of participating countries for the first time, and also it is the first year of that Turkey participated into the PISA. Moreover problem solving is one of the main skills of the new education paradigm. Problem solving result of Turkey was below OECD average in PISA 2003 and 2012. Therefore, PISA 2003 and PISA 2012 problem solving results have been analyzed comparatively in the study. Therefore, this study is aimed to investigate the results of problem solving skill of Turkey in terms of different variables. Therefore it is aimed to

- Analyze the mathematical literacy and problem solving proficiency level of Turkey in PISA 2003 and 2012,
- Analyze PISA 2003 and 2012 problem solving test results of Turkey in terms of school types and gender,
- Analyze PISA 2003 and 2012 problem solving test results of Turkey in terms of the curriculums published in 2004 and 1995.

In the study, problem solving skill results in PISA 2003 and 2012 of Turkey would be analyzed in terms of gender, school type and curriculum. It is thought that comparison of PISA 2003 and 2012 problem solving results according to different variables would contribute to mathematics education in Turkey in terms of examining problem solving competency. It is expected that Turkey's PISA results would be useful for finding out effectiveness of curriculum in practice at the end of study. Therefore, the research problem is as follow:

How does Turkey's problem solving test results in PISA 2003 and PISA 2012 change according to gender, curriculum and school types?

2. METHOD

2.1 Research Design

The study is a qualitative research. Qualitative studies are the researchers studying a phenomena, relation or the quality of case (Fraenkel, Wallen & Hyun, 2012). The case study, which is one of the qualitative research design, was selected for the research design. Case study is a study types investigating one or more cases deeply (Yin, 2014). In case study, interview, observation, focus group interview or document analysis can be used as data collection tools.

Document analysis was used in the study. Document analysis is to analyze materials related to research topic. These materials can be both written materials (book, magazine, dairy, formal report, statistics or letter etc.) and movie, videos or photographs (Owen, 2013). Therefore the formal reports published by OECD and Ministry of National Education and scientific researches were used in the study while document analysis was processed.

2.2 Data Collection and Analysis

In the study document analysis, a qualitative research method, was used as data analysis method. In this study, reports and researches published by OECD and MNE (Ministry of National Education, Turkey) in 2003-2012 were used in the study as first data collection tools. Also articles, thesis and dissertations and reports published in domestic and international database (ERIC, Taylor & Francis, Sage Journals, Elsevier, National Thesis Centre, ProQuest etc.) within 2004-2014 were used to interpret in these data in the study. The study was limited to the database used in the study and the published years 2004-2014. Two experts in the field were asked for the reliability and validity of the documents used in the document analysis. Document analysis has many steps. In the study the following steps were followed in the analysis of document.

- Locating the document: What kind of document were needed and how they were reached were identified in terms of research question. So OECD and MNE reports including PISA 2003 and 2012 scores and curricula published by MEB in 1995 and 2004 were reached. OECD and MNE reports about PISA 2003-2012 were used as a main resource.
- Confirming the document's originality: The data used in the study were the primary data. They were obtained from OECD and MNE's formal websites.
- Understanding the document: OECD PISA 2003 and 2012 reports, MNE PISA 2003 and 2012 reports and the data about problem solving in the curricula published by MNE in 1995 and 2005 were analyzed comparatively.
- Analyzing the data: Data set was included all the document and they were analyzed into three categories according to research question. The data obtained in the study were analyzed in terms of gender, curriculum and types of school. Data consistency were done by two different experts. The data relating to every one of the skills –problem solving skill and mathematical literacy- were analyzed according to the variables, and so findings were reported as a plain text. The data obtained from data analysis were classified according to the categories. Every category was evaluated according to its sub-fields.

3. FINDINGS

Turkey's problem solving results in the study have been shown at the tables comparatively with the other countries which are above and below OECD level because of figuring out Turkey's level and position in the other participating countries.

3.1 Analysis of mathematical literacy proficiency levels of Turkey in PISA 2003 and 2012

While mathematical literacy highest score was belonged to Hong Kong – China having 550 points, the poorest score was Brazil's (356 points). According to PISA 2003, students from Turkey got 423 points were at level 2 in terms of average score (OECD, 2004). The following table shows countries' mathematical literacy score which participated in the PISA 2003-2012 and were top scorers.

Table 1. Average score and ranking of mathematical literacy in PISA 2003 and 2012

	Average score in mathematical literacy		Ranking	
	PISA 2003	*PISA 2012*	*PISA 2003*	*PISA 2012*
Shanghai	-	613	-	1
Hong Kong	550	561	1	3
Finland	544	519	2	12
Korea	542	554	3	5
Netherlands	538	523	4	10
Liechtenstein	536	535	5	8
Japan	534	536	6	7
Canada	532	518	7	14
Turkey	423	448	36	44
Brazil	356	391	40	58

Shanghai - China had the highest performance with 613 points while Peru showed the lowest performance with 367 points in mathematical literacy. According to PISA 2012 results, Turkey had 448 points in mathematical literacy and was at level 2 (OECD, 2013a).

According to some research results (Gülten, 2013), students' views on quantitative subjects were not statistically significant on mathematical literacy proficiency level while Akyüz and Pala's study (2010) concluded that there was a strong relationship between mathematical literacy and problem solving skill in their study. According to their study, the relationships among proficiency levels of problem solving and mathematical literacy of Turkey, Finland and Greece were different. So mathematical literacy score and problem solving score are parallel with each other when analyzing PISA 2003 and 2012 score of Turkey.

3.2 Analysis of problem solving skill proficiency level of Turkey in PISA 2003 and 2012

Finland, Japan, Korea and Hong Kong showed better performance than the other countries in PISA 2003. According to PISA problem solving scale, Turkey's score was below level 1 (OECD, 2004a). According to PISA 2012 problem solving results, students from Turkey scores were at level 2.

Table 2. Problem solving scores and proficiency levels of PISA 2003 and 2012

	Average score of problem solving		Ranking	
	PISA 2003	*PISA 2012*	*PISA 2003*	*PISA 2012*
Korea	550	561	1	2
Hong Kong	548	540	2	4
Finland	548	523	2	9
Japan	547	552	3	3
Belgium	525	508	8	18
Switzerland	521	-	9	-
Turkey	408	454	36	36
Tunus	345	-	40	-

The reason of the fact that Turkey were at low levels in PISA 2003 and 2012 may be said that students are not used to problem situations and types in PISA. According to some studies in the literature, mathematical course book deals with problem solving traditionally (Aydın, Sarıer & Uysal, 2012; Kılıç, 2013). Unlike problems in PISA, it is observed that the problems in the mathematics textbooks are on familiar to the students. Likewise it is understood that the problems especially word problems are not real problem situations, and moreover they could be called as exercise or question. When analyzed average score of Turkey in PISA 2003 and 2012, Turkey was at the same ranking. It is seen that top performers of PISA like Finland, Hong Kong and Korea focus on problem solving in their curriculum and integrate it with every discipline,

thus it can be said it affects their performance in PISA (Bakioğlu & Yıldız, 2013; Cai & Nie, 2007; Çobanoğlu & Kasapoğlu, 2010). Although there is no significantly difference between average score of Turkey in PISA 2003 and 2012, it can be said that there is an improvement in its score points and ranking. It may be due to the number of countries participating into PISA 2012 compared to PISA 2003. According to related research results, it is concluded that students have more success with the problems presented with simulation in the computer (Jerrim, 2016; Liu, Cheng & Huang, 2011; Repenning, Basawapatna & Klymkowsky, 2013). So PISA 2012, presenting problems with simulation, may create more suitable environment for students than PISA 2003 done in paper based environment. Integrating technology into schools provides more visual and different environments. Research results show that computer-based game activities especially for problem solving skill develop students' thinking and problem solving skills (Al-Rsai, 2013; Denner, Werner & Ortiz, 2012; Jerrim, 2016).

3.3 Analysis of problem solving skill results in PISA 2003 and 2012 in terms of types of school

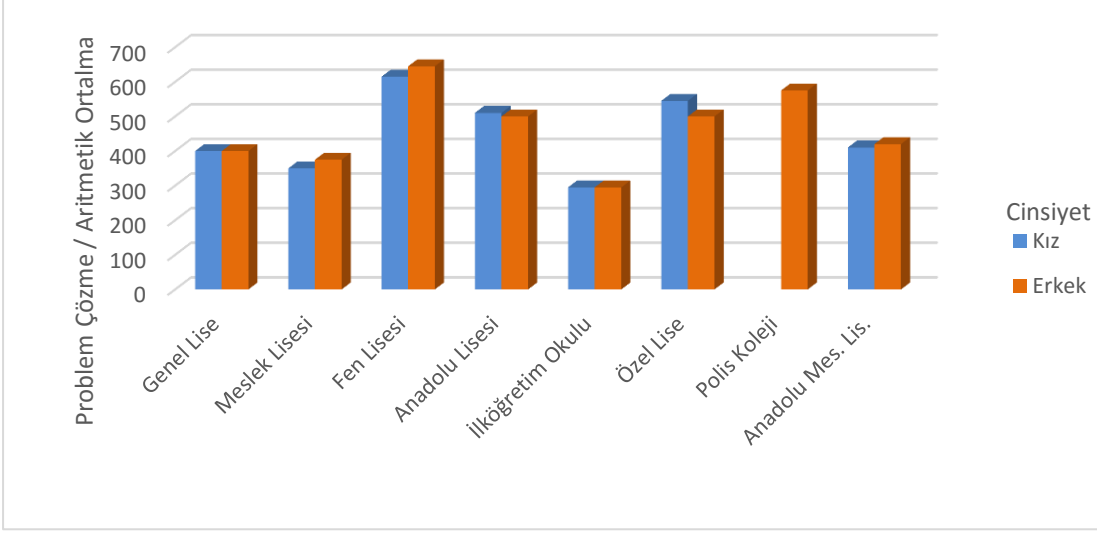

Figure 1. Success Ranking according to types of school in PISA 2003 Problem Solving

When the figure, showing different school types score in PISA 2003, above is analyzed, it is seen students studying at science high school showed better performance than other students studying at other school types. Students in vocational high school had the lowest points in problem solving test in PISA 2003.

Male students in science high school got higher points than female students in problem solving. According to research in the relating literature, students having success in international tests like PISA and TIMMS attend mostly with school high socio-economic status (Aydın et al., 2012). Therefore, it may be said the variables like schools' physical environment, teacher proficiencies and teaching materials have positive effect on students' success. It is considered that science high school, Anatolian high school, private high school and Police College are more successful than vocational high school, general high school and Anatolian vocational high school in terms of physical environment and financial possibility.

Table 3. Categories of problem solving performance in PISA 2012 according to types of school

	Turkey
Relative strength in problem solving with the other skills	Anatolian vocational high school (5.7%) Technical high school (1.5%) Anatolian technical high school (2.5%)
Students' performance in problem solving in line with their performance in mathematics, reading and science	Primary school (2.7%) General, Science and Social Sciences high school (32.2%) Anatolian high school (22.5%) Vocational high school (24.7%) Multi programme high school (4.5%)
Relative weakness in problem solving with the other skills	Anatolian teacher training high school (4.5%)

Numbers in parentheses indicate the proportion of 15-year-olds in the study programme.

According to PISA 2012 problem solving scores, students studying at vocational high school performed better than expected. Students studying at Anatolian vocational, Technical and Anatolian Technical High School had stronger relationship with problem solving than other fields of PISA. Primary school, General, Science and Social Sciences, Anatolian, Vocational and Multi-program high schools students' performance at problem solving are aligned with their performance on other fields of PISA. It may be said the reason for the fact that students at studying vocational high school in PISA 2012 had higher score results from their life-oriented courses and more practice. Students studying at vocational schools are observed to have more successful in solving life-oriented problems they never encounter in school (Biber & Kutluca, 2013; Marsigit & Rosnawati, 2011).

3.4 Analysis of problem solving skills of PISA 2003 and 2012 in terms of gender

According to PISA 2003 results, there is a slight difference in problem solving scores between male and female students but this difference is not statistically significant (Brunner, Gogol, Sonnleitner, Keller, Karuss & Preckel, 2013; Roman & Rica, 2012). Male students in 23 countries had better performance than female students according to PISA 2012 problem solving results while female students in just 5 countries got better score than male students. There is no statistically significant difference between female and male students in other 16 countries (OECD, 2014a).

The report (2014) about problem solving published by OECD states that male students have better performance in problem solving than female students in both PISA 2003 and 2012. The related studies in the literature conclude that although there is no high difference between female and male students in problem solving skills, male students have score in favor of them (Brunner et al., 2013; Wüstenberg, 2013). Gender differences' psychological, physical and environmental effects, gender hormones effects, stereotype about gender and life experiences is observed to affect significantly problem solving skill (Çelikkaleli & Gündüz, 2010; Tümkaya, Aybek & Aldağ, 2009; Zhu, 2007).

Table 4. Average scores of PISA 2003 and 2012 problem solving skill of Turkey

	Average score in problem solving	Proficiency level	Total number of countries participating into it	Total number of OECD countries	Ranking in all countries		Ranking in OECD countries	
					Lower ranking	Higher ranking	Lower ranking	Higher ranking
2003	408	Level 1	40	29	36	34	28	28
2012	454	Level 2	44	28	36	33	28	28

Problem solving is defined as a main skill aimed to develop in mathematic curriculum published by Ministry of National Education in 2004 (MEB, 2009b). When Turkey's score of PISA 2003 and 2012 was analyzed, it was at level 1 below with 408 point in 2003 while level 2 with 454 in 2012.

The curriculum published in 2004 aim to improve some important skills and mathematical interpretation from instinct or concrete experiences. Skills aimed to improve are problem solving, communication, reasoning and associate (MEB, 2009a; 2009b). Students' roles and skills are not defined clearly in the 1995 curriculum. Although problem solving is in the general objective of 1995 curriculum, it is approached as a subject. But the curriculum published in 2004 has integrated problem solving into mathematics curriculum as an approach and a skill aimed to improve. Therefore it can be said that Turkey's problem solving average score differences - 46 points- between PISA 2003 and 2012 result from the different approaches of mathematics curriculum. It is said that problem solving makes students more successful compared to PISA 2003 with integrating it into the curriculum as an approach and integrated with all subjects. Turkey's globalization process since 1990s has aimed at assessing educational studies with different approaches. As 1995 curriculum aimed at generally fulfilling national aims, there was no enough practices to develop basic life skills such as life-long learning or problem solving. However individuals' basic life skills have been aimed to develop by integrating them into the curriculum prepared by Ministry in 1995 (Sağlam, Özüdoğru & Çıray, 2011; Türer, 2010). So, Turkey's success in PISA 2012 can be said to result from the integration of problem solving into the curriculum.

4. RESULTS AND DISCUSSION

PISA assess students' problem solving skills in the year which is focused on mathematical literacy because of the fact that PISA focuses on one of the its sub-fields –mathematical literacy, science literacy, reading skills- every year. So, problem solving and mathematical literacy has significant correlation based on the related studies. Problem solving links with expected and needed data for problem solution while there is a problem solving process. Therefore, in many countries problem solving is included into the curriculum as a skill. Accordingly, the problem cases, presented in schools, involve many real life situations they come across in their daily life (Greiff, 2012; Thomson, 2013). So students must be well-supported for the solution of problem.

One of the aims of the study was to analyze PISA 2003 and 2012 Turkey's both mathematical literacy and problem solving proficiency level. According to findings, Turkey has some progress in mathematical literacy score of PISA 2012 but its proficiency level is on the same. Turkey got 423 points in PISA 2003 and 448 points in PISA 2012, and moreover Turkey's proficiency level was at Level 2 in both PISA 2003 and 2012. Relevant studies find out mathematics textbooks have different topics but their problem types are similar to each other in Turkey (Altun & Akkaya, 2014; Köse & Anıl, 2013). So different types of problems in PISA may be said to affect students' success as they cause to come across new situations. Introduction, presentation and conclusion activities in mathematics teaching affects quality of course and student learning. Thus, mathematics education should involve real life situations (Oral & Sözer, 2013; Turner, 2016). When analyzed mathematical literacy average score of PISA 2003 and 2012, it is in favor of male students. This result is parallel with the relevant studies results (Demir & Kılıç, 2010; Zaman, Farooq, Ghaffar, Ali & Naz, 2014; Turner, 2016).

According to the findings, there are some differences among students' scores from different schools when PISA 2003 and 2012 is analyzed in terms of school types. Students studying at science high school have been concluded to be more successful than other students studying at the other schools. According to PISA 2003 problem solving results, students, having the lowest average score, are from vocational high school and primary school.

It may be thought that the reason of the fact that students from vocational high school got the lowest score and students from science high schools got the highest scores are related to their education programme implemented. Learning outputs of schools are very different from each other according to research result (Berberoğlu & Kalender, 2005). Since students studying at vocational high schools have limited options in the university entrance exam, they may direct to different study fields. Students with lower performance in high school entrance exams, could select vocational high schools. Therefore score differences among types of school may be said to associate with successful students to choose other schools rather than vocational high schools. The educational differences between school types has caused students' success differentiation. So the relationship between educational settings and poverty and average score of student could tell us that reducing low performance may be the most effective way of improving the overall educational outcomes (Villar & Fellow, 2016). Students studying at vocational high schools and preparation year in the vocational high schools performed better than expected in PISA 2012 compared to PISA 2003. One of the objectives targeted by Turkish Republic government until 2023, which is to promote vocational training, formed training programme of vocational high schools updated with life-long learning skills for real life problems (OECD, 2013b). It might be said that vocational high school students' performance in problem solving results through targeted and developed strategies. No sooner Ministry of National Education's decision, taken in 2010, is about adding coefficient differences among schools while entering into university entrance exam, then it has provided successful students to choose vocational high schools. Therefore, students could be said to perform better in PISA 2012 because of their preference of vocational students toward the strategies developed for vocational high schools and update on its training programme.

One of aims of the study was to analyze gender differences between PISA 2003 and 2012 problem solving scores. According to the findings, male students performed better than female students when PISA 2003 and 2012 problem solving results was analyzed in terms of gender, but the difference between male and female students is not statistically significant. According to research result it is seen that the number of schools are not parallel with population growth rate (Çelik, Önal & Yeler, 2012). So it could be said the low schooling rate and cultural aspect of society, which appealed to more male students than female students, make the difference between male and female students. Moreover, although the difference between them is not statistically significant according to research results about problem solving, and so male students can be said to be more successful than female students (Alshamali & Daher, 2015; Brunner et al., 2013; Roman & Rica, 2012; Wüstenberg, 2013). In line with the research in the literature, seemingly male students compared to female students have been seen to be more successful in decision-making and problem solving in terms of psychology and also they are tend to take much more risk than female students (Mgbame, Izedonmi & Enofe, 2012). At this point one of the reason of the fact that male students have higher scores than female students could be said to be concerned with social description due to roles of women and men and cultural values. But De San Roman & De La Rica's study (2016) have stated that girl's performance with respect to boys is better in families where the mother is active in the labour market. So it could be said that the mother's position or role in a family has a very important for performing of girls.

According to the results of the study, Turkey's problem solving score in PISA 2012 has been increased compared to PISA 2003, but its performance ranking has been at the same. It might be resulted from approaching problem solving as general rather than a specific perspective (Akyüz & Pala, 2010). It is observed that problem solving practices are not adapted into training process although curriculum

consider it as a basic skill (Aydın et al., 2012; İskenderoğlu & Baki, 2011; Kıray & İlik, 2011; Polivanova, 2015). Hence Turkey's lower ranking may be thought to derive from the fact that problem solving skill is not included into curriculum as an approach. According to the related research results (Timmers, Walraven & Veldkamp, 2015), it can be said that problem solving implemented as computer-based-test affects students' average score in problem solving in PISA 2012.

Programme for International Student Assessment results are considered as an important indicator for finding out problems in their curriculum and correcting them by participating countries. The critical report about results in PISA published by the researchers around the world says that PISA ranking of countries affect their education system negatively. The results of implementation of PISA in three-year period are stated to cause the participating countries to suggest short-term solutions with the aim of making necessary provisional adjustments. So, assessment cannot be performed according to a criteria, and moreover standard tests cannot be enough to assess student's success according to modern educational perspective including alternative assessment methods ("Academics Letter", 2014). It might be said that PISA tests about different topics may not reflect students' whole success in participating countries exactly. Performance differences among countries may be said to result from their different regional, national or international education practices and policies. Despite to critical perspective of PISA, its results could be considered to help Turkey find out deficiencies in especially students' success and curriculum.

According to the research results, problem solving skills should be suggested to integrate in the subjects as a basic life skill while determining educational policies for future studies. The course content should be suggested to revise again based on problem solving skills as a main life skill for the students studying at different levels. For the future studies, it is thought to contribute that the curriculum content and educational activities implemented in Turkey and the other countries performing the highest scores in PISA would be analyzed comparatively. It can be suggested to compare PISA 2015 results of Turkey with other country results and other PISA results of Turkey as the study is limited with PISA 2003 and 2012 problem solving results of Turkey. Moreover it can be suggested that future studies would compare Turkey's other sub-field results with each other or other countries' results.

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