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Pre-Service Teachers' Problem Solving Skills and Curiosity Levels *

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Abstract: The aim of the study is to examine the pre-service teachers' problem solving skills and curiosity levels according to different variables and to determine whether there is a relationship between them. The research was designed as a descriptive study in the survey model. The sample of the study consists of 1st and 4th grade pre-service teachers in the departments of German, Science, English, Mathematics, Music, Pre-school, Painting, English, Mathematics, Turkish Language Teaching at a university in Turkey. "Curiosity Scale" adapted into Turkish by Demirel and Diker Coskun, "Problem Solving Inventory" adapted into Turkish by Sahin, Sahin and Heppner and "Personal Information Form" prepared by the researcher were used as data collection tools. In the analysis of the data obtained, SPSS-Windows 22.00 package program was used and descriptive statistics and parametric tests were applied in accordance with the sub-problems of the study. In addition, a correlation analysis was conducted to determine whether there was a relationship between pre-service teachers' problem solving skills and curiosity levels. Based on the findings, suggestions about the problem solving skills and curiosity levels of the prospective teachers were presented.

Keywords: *Problem solving skill, curiosity, pre-service teacher.*

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Introduction

In the information society, when the expected human qualities are examined, we usually encounter with the qualities such as reaching information, analyzing the information, choosing the useful information, organizing them, controlling the learning process, working in teamwork and cooperate (Kara, 2008). The aim of the curricula in the framework of the 2004 reform of education in Turkey; to raise individuals with questioning, critical thinking, problem-solving skills, and individuals willing to research; and to create learning environments where students are active and can participate one on one (Yetkin & Dascan, 2008). Problem solving is the foundation of a young child's learning. It must be valued, promoted, provided for, and sustained in the early childhood classroom. Opportunities for problem solving occur in the everyday context of a child's life. By observing the child closely, teachers can use the child's social, cognitive, movement, and emotional experiences to facilitate problem solving and promote strategies useful in the lifelong process of learning (Britz, 1993).

The rapid change in science and technology, the changing needs of the individual and the society, the innovations and developments in learning-teaching theory and approaches, which are expressed in the curricula updated in 2018 at Turkey, are directly affected the roles expected of individuals. This change produces information, can use it as a functionally functional, can solve problems, think critically, have entrepreneurial, stable, have communication skills, empathy, contribute to society and culture. (MEB, 2018a; MEB, 2018b; MEB, 2018c). The problem-solving skills, which are among the common basic skills that are aimed to be taught to the students, include the skills needed to solve the problems that will be faced in the student's life. Problem solving is a skill that can be learned and must be practiced. It is facilitated by a classroom schedule that provides for integrated learning in large blocks of time, space for ongoing group projects, and many open-ended materials. The teacher provides the time, space, and materials necessary for in-depth learning (Britz, 1993).

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According to Senemoglu (2005), problem solving also includes, curiosity and being a researcher. Therefore, children are natural problem solvers. What teachers need to do is to enrich these characteristics of children by organizing appropriate educational experiences. One of the characteristics of the individual who can solve problems in this context is being curious. Curiosity is a concept defined as a desire to understand or learn something (TDK, 2016). Because, humans are an entity that thinks, judges, questions and discusses by nature. They wonder many things and want to learn (Demirel & Diker Coskun, 2009). Continuous learning is about being willing to learn. It is important to educate curious students and to support them in their curiosity. Because, it can be thought that curious students can solve problems more easily.

The individual, who is aware of the problem, is able to specify the difficulty or the source of the conflict which causes the problematic situation, is capable to deal with the problem. Contrary to that, the individual who is not able to be aware of the problem, is albeit experiencing the feeling superimposed by curiosity, however, does not realise what causes the difficulty, which obstacle that causes the conflict has to be removed, and, therefore, he is not able to remove it (Dostal, 2015). Also among the goals of Turkey's education system, there is raising individuals who wonder, do not hesitate to ask questions, notice problems, and query (MEB, 2018a).

Curiosity is defined as an internal state occasioned when subjective uncertainty generates a tendency to engage in exploratory behaviour aimed at resolving or partially mitigating the uncertainty (Berlyne, 1978). Curiosity can improve asking questions and making inquiries. We can maintain continuous learning by being curious. Continuous learning is about being willing to learn. Einstein, about himself, said, "Follow your curiosity. I don't have a special talent. I'm just a passionate curious", and It may be thought that he emphasizes the importance of being curious. Being curious, being willing to learn are the characteristics that should be in the student. Students should be curious to adapt to the era. One of the opinions regarding curiosity often expressed is that almost all young children are highly curious but they seem to lose this characteristic very soon after they enter school. If this is true-and there is very little empirical evidence on which to either accept or reject the opinion-it does not explain why some children and some adults seem to retain a very high level of curiosity (Maw & Maw, 1966). Teachers should also be curious about both student development and their personal improvement. As stated in the curricula, teachers who aim to raise students that are curious, investigative and questioning, and who can solve problems has a great responsibility. Because of this, for teachers and pre-service teachers, having problem solving skills and a high level of curiosity are very important in terms of educating students with the same characteristics.

As seen in the literature, there are a lot of studies that investigate the problem solving skills. But in this study, the participants are the pre-service teachers so, here the studies whose participants are the pre-service teachers. (Aksan & Sozer, 2007; Altuncekic, Yaman & Koray, 2005; Alver, 2005; Aslan & Sagir, 2012; Baker, 2003; Bakioglu, Kucukaydin & Karamustafaoglu, 2015; Cevik, 2011; Evrekli, Inel & Turkmen, 2011; Genc & Kalafat, 2007; Gurleyuk, 2008; Kesicioglu & Guven, 2014; Kiremitci, 2011; Korkmaz & Usta, 2010; Kurtyilmaz, 2005; Piji Kucuk, 2012; Otacioglu, 2011; Ozkutuk, Silku, Orgun & Yalcinkaya, 2003; Polat & Tumkaya, 2011; Saracaloglu, Yenice & Karasakaloglu, 2009; Sara, 2012; Yenice, 2012; Yildirim & Yalcin, 2008). In Jaffee & Zurilla's study, (2003) the adolescents' problem solving skills and criminal behaviours were determined. In another study Baker (2003) investigated the correlation between problem solving skills and stress. Sukhodolsky, Golub, Stone & Orban (2005) determined the anger control and problem solving skills. D'Zurilla & Nezu (1987) stated that decision making is a stage of problem solving process. When these studies and the studies above were examined, it was seen that, the level of problem solving skills were determined and the problem solving skills were investigated with different variables. As mentioned above in the literature, it can be said that individuals who are curious, have higher problem solving skills. Because curiosity can improve asking questions and making inquiries. There are many researches that investigated the pre-service teachers' curiosity levels with different variables (Acun, Kapikiran & Kabasakal, 2013; Aldan Karademir, Cayli & Deveci, 2016; Darancik, 2018; Demirel & Diker Coskun, 2009; Deringol, Yaman, Ozsari & Gulten, 2010; Gulten, Ozsari, Yaman & Deringol, 2010; Kashdan, Rose & Fincham, 2004; Litman & Spielberger, 2003; Unal, 2005; Whitesides, 2018).

In these studies, curiosity has been studied alone or with different variables, but no research was found in which problem solving skills and curiosity levels were determined together. Therefore, in this research, problem solving skills and curiosity levels of pre-service teachers are discussed together. From this point of view, the purpose of the study is to examine the pre-service teachers' problem solving skills and curiosity levels according to different variables and to determine whether there is a relationship between them.

Methodology

In this section, research goal, sample and data collection, and analyzing of data were explained respectively under headings.

Research Goal

The aim of the study is to determine the problem solving skills and curiosity levels of pre-service teachers. In line with this main objective, answers to the following questions were sought.

1. What is the level of pre-service teachers' problem solving skills?
2. Do the pre-service teachers' problem solving skills differ significantly according to gender, grade level, department and the department choice reason?
3. What is the level of pre-service teachers' curiosity?
4. Do the pre-service teachers' curiosity levels differ significantly according to gender, grade level, department and the department choice reason?
5. What is the relationship among the pre-service teachers' problem solving skills and curiosity levels?

Sample and Data Collection

The research was designed as a survey research that is one of the most common forms of research engaged in by educational researchers. It involves researchers asking a large group of people questionsa about a particular topic or issue (Fraenkel & Wallen, 1993). In this research, a large group of pre-service teachers' problem solving skills and curiosity levels were determined by asking many questions. So this research merthod was used. The valid and best way to select a representative sample is random sampling. In the sampling, if the sampling unit is an element, the process is called element sampling, and if it is a group, then it is called cluster sampling. The sample of the study was selected by random sampling method, and the sampling unit was determined by the cluster sample (Buyukozturk, Kilic Cakmak, Akgun, Karadeniz & Demirel, 2011). A total of 823 pre-service teachers participated in the study. The sample of the study consists of pre-service teachers' who are studying in the 1st and 4th grades in the undergraduate programs of German, Science, English, Mathematics, Music, Pre-school, Painting, English, Mathematics, Turkish Language Teaching Department at a university in Turkey. The distribution of pre-service teachers by gender and grade level is as follows: Female (N= 551), Male (N=272), 1th Grade (N=404) and 4th Grade (N=419).

Within the scope of the study, "Problem solving Inventory" developed by Heppner & Peterson (1982) and adapted to Turkish by Sahin, Sahin & Heppner (1993), was used to determine the problem solving skills of pre-service teachers. "Problem solving Inventory" is a 35-item and 6 likert type scale with six sub dimensions. Sub dimensions were labeled as impulsive, reflective, avoidant, monitoring, problem solving confidence and planfulness. Impulsive sub dimension was consisted of nine items. An example item is *"When confronted with a problem, I tend to do the first thing that I can think of to solve it."* The second sub dimension, reflective, was consisted of five items such as; *"When making a decision, I weigh the consequences of each alternative and compare them against each other."* Avoidant sub dimension was consisted of four items and an example item is, *"When a solution to a problem was unsuccessful, I do not examine why it didn't work.".* Monitoring and planfulness sub dimensions were consisted of four items and the problem solving confidence sub dimension was consisted of six items. *"After I have tried to solve a problem with a certain course of action, I take time and compare the actual outcomes to what I thought should have happened."* is an example item for monitoring, *"When faced with a novel situation, I have confidence that I can handle problems that may arise."* is an example item for problem solving confidence and *"I make decisions and I am happy with them later."* is an example item for planfulness. Cronbach's alpha internal consistency coefficient of the scale is .88. In this study, Cronbach's alpha internal consistency coefficient of the related scale was determined as .87. "Curiosity Scale" adapted to Turkish by Demirel & Diker Coskun (2009), "Personal Information Form" prepared by the researches to determine the demographic features were used. "Curiosity Scale" is a 47-item and 6 likert type scale with two sub dimensions. First was labeled as "breadth" consisted of 27 items and the second was labeled as "depth" consisted of 20 items. Items are about examining a wide range of information in "Breadth" sub dimension. "Depth" sub dimension is that the person is curious about a certain subject, idea, person and tries to learn about them in a continuous manner. Cronbach's alpha internal consistency coefficient of the scale is .86. In the study, Cronbach's alpha internal consistency coefficient of the related scale is determined as .88. The data obtained from the sample were analyzed by SPSS (Statistical Package for the Social Sciences) 22.0 package program.

Analyzing of Data

In the analysis of the data, it was examined whether the data were normally distributed or not in order to decide which statistical tests would be done. Kolmogorov Smirnov test results for the scale totals and all sub dimensions of the "Problem Solving Inventory", "Curiosity Scale" were analyzed, and also Skewness values were found between +1 and -1 whereas Kurtosis values were between +2 and -1. The determined Skewness and Kurtosis values are acceptable limit values where it shows normal distribution according to Huck (2008) (Secer, 2015). Therefore, since the data in the research shows normal distribution and the other assumptions were provided, multivariate analysis of variance (MANOVA) were applied to the data. As a result of the analyzes, the source of the difference between the groups was examined with Tukey HSD from post-hoc tests. In order to determine problem solving skills and curiosity levels, frequency, arithmetic mean and standard deviation values were calculated. Pearson correlation analysis was made to determine whether there is a significant relationship between problem solving skills and curiosity levels.

Findings / Results

In this section, findings obtained from the pre-service teachers with data collection tools are presented respectively as headings in line with the sub problems.

Findings related to the first sub-problem

The analysis result of the "What is the level of pre-service teachers problem solving skills?" sub-problem is given in

Table 1. Pre-service teachers' Problem Solving Skills

Problem solving	N	x̄	SD
impulsive	823	28.99	6.36
reflective	823	22.95	4.55
avoidant	823	16.13	5.06
monitoring	823	13.60	3.16
problem solving confidence	823	26.21	5.09
planfulness	823	18.24	3.68
problem solving total	823	129.63	17.42

"Problem Solving Inventory" is a 6-point Likert-type scale which is graded from "always behave like this" to "never behave like this". For this reason, the highest 210 and the lowest 35 points can be obtained from this 35-item scale. Obtaining 122.5 points from this scale was determined as average score. In the study, pre-service teachers' problem solving skills (M= 129.63; SD: 17.42) are seen to be above the average value.

Findings related to the second sub-problem

The analysis results of the "Do the pre-service teachers' problem solving skills differ significantly according to gender, grade level, department and the department choice reason?" sub-problem are given as headings, respectively.

Problem solving skills - gender

Table 2 shows the results of MANOVA to determine whether the pre-service teachers' problem solving skills significantly differ based on gender variable.

Table 2. MANOVA Results of Pre-service Teachers' Problem Solving Skills Based on Gender

Problem solving	Gender	N	M	SD	MS	df	SS	F	p
impulsive	Female	551	29.21	6.59	83.549	1	83.549	2.066	.151
	Male	272	28.54	5.85					
reflective	Female	551	23.15	4.50	72.346	1	72.346	3.503	.062
	Male	272	22.52	4.62					
avoidant	Female	551	16.25	4.95	23.455	1	23.455	.915	.339
	Male	272	15.89	5.28					
monitoring	Female	551	13.85	3.10	99.458	1	99.458	10.011	.002
	Male	272	13.11	3.24					
problem solving	Female	551	26.33	5.03	23.315	1	23.315	.898	.344
confidence	Male	272	25.97	5.21					
planfulness	Female	551	18.38	3.68	33.488	1	33.488	2.474	.116
	Male	272	17.95	3.66					
problem solving	Female	551	130.73	17.36	2008.979	1	2008.979	6.666	.010
total	Male	272	127.41	17.35					

(λ= 0.980, F=2.356, p<.05)

It was determined that there was a significant difference in terms of gender according to scores obtained from the "monitoring" sub dimension and the "Problem Solving Inventory" total [Wilks Lambda (λ)= 0.980, F=2.356, p<.05]. This significant difference at "monitoring" sub dimension [F=10.01, p<.05] and at the "Problem Solving Inventory" total [F=6.66, p<.05] is in favor of female pre-service teachers.

Problem solving skills – grade level

Table 3 shows the results of MANOVA to determine whether the pre-service teachers' problem solving skills significantly differ based on grade level variable.

Table 3. MANOVA Results of Pre-service Teachers' Problem Solving Skills Based on Grade Level

Problem solving	Grade level	N	M	SD	MS	df	SS	F	p
impulsive	1st grade	404	29.25	6.09	53.04	1	53.04	1.310	.253
	4th grade	419	28.74	6.61					
reflective	1st grade	404	22.99	4.23	1.18	1	1.18	.057	.811
	4th grade	419	22.91	4.84					
avoidant	1st grade	404	16.11	4.97	0.31	1	0.31	.012	.912
	4th grade	419	16.15	5.15					
monitoring	1st grade	404	13.54	3.19	3.27	1	3.27	.325	.569
	4th grade	419	13.67	3.14					
problem solving	1st grade	404	26.23	4.99	0.12	1	0.12	.005	.944
confidence	4th grade	419	26.20	5.19					
planfulness	1st grade	404	18.37	3.43	12.82	1	12.82	.945	.331
	4th grade	419	18.12	3.90					
problem solving	1st grade	404	129.98	16.84	94.29	1	94.29	.310	.578
total	4th grade	419	129.30	17.97					

(λ= 0.991, F=1.005, p>.05)

It was determined that there was no significant difference in terms of grade level according to scores obtained from the Problem Solving Inventory [Wilks Lambda (λ)= 0.991, F=1.005, p>.05] and that the scores obtained by "Problem Solving Inventory" from 1st grade and 4th grade pre-service teachers were close to each other.

Problem solving skills – department

The result of the MANOVA to determine whether the pre-service teachers' problem solving skills significantly differ based on department variable is given in Table 4.

Table 4. MANOVA Results of Pre-service Teachers' Problem Solving Skills Based on Department

Problem solving	Department	N	M	SD	MS	df	SS	F	p
impulsive	Science	138	27.39	6.12	177.753	6	1066.516	4.501	.000
	Primary	151	28.05	6.92					
	Turkish	97	29.51	6.32					
	Social Sciences	86	30.15	5.69					
	English	148	30.64	5.57					
	Mathematics	80	29.31	4.96					
	Pre-school	123	28.51	7.46					
	Total	823	28.99	6.36					
reflective	Science	138	22.17	4.64	33.754	6	202.521	1.637	.134
	Primary	151	23.20	4.57					
	Turkish	97	22.60	5.00					
	Social Sciences	86	23.94	4.64					
	English	148	22.90	3.78					
	Mathematics	80	22.78	3.92					
	Pre-school	123	23.25	5.08					
	Total	823	22.95	4.55					
avoidant	Science	138	14.39	5.31	95.554	6	573.324	3.805	.001
	Primary	151	16.25	5.28					
	Turkish	97	16.10	5.02					
	Social Sciences	86	16.27	5.40					
	English	148	16.77	4.36					
	Mathematics	80	17.15	4.34					
	Pre-school	123	16.41	5.14					
	Total	823	16.13	5.06					

Table 4. Continued

Problem solving	Department	N	M	SD	MS	df	SS	F	p
monitoring	Science	138	13.11	3.16	23.942	6	143.651	2.408	.026
	Primary	151	13.99	3.29					
	Turkish	97	13.38	2.97					
	Social Sciences	86	13.86	3.18					
	English	148	13.13	3.20					
	Mathematics	80	13.70	2.79					
	Pre-school	123	14.20	3.23					
	Total	823	13.60	3.16					
problem solving confidence	Science	138	25.09	4.53	62.109	6	372.651	2.417	.025
	Primary	151	26.49	5.02					
	Turkish	97	25.88	4.95					
	Social Sciences	86	27.60	5.39					
	English	148	26.32	5.13					
	Mathematics	80	26.01	4.71					
	Pre-school	123	26.43	5.65					
	Total	823	26.21	5.09					
planfulness	Science	138	17.45	3.74	39.183	6	235.101	2.930	.008
	Primary	151	18.77	3.51					
	Turkish	97	17.81	3.78					
	Social Sciences	86	18.81	3.62					
	English	148	18.15	3.54					
	Mathematics	80	17.78	3.45					
	Pre-school	123	18.83	3.90					
	Total	823	18.24	3.68					
problem solving total	Science	138	122.81	14.17	1528.904	6	9173.423	5.192	.000
	Primary	151	130.25	16.57					
	Turkish	97	128.95	17.32					
	Social Sciences	86	134.05	19.84					
	English	148	131.79	17.99					
	Mathematics	80	130.08	15.74					
	Pre-school	123	131.07	18.57					
	Total	823	129.63	17.42					

(λ= 0.892, F=2.222, p<.05)

It was determined that there was a significant difference in terms of department according to scores obtained from the all sub dimensions and the "Problem Solving Inventory" total except only "reflective" sub dimension [Wilks Lambda (λ)= 0.892, F=2.222, p<.05]. The points obtained from the sub dimensions of the problem solving scale were "impulsive" [F=4.501, p<.05], "avoidant" [F=3.805, p<.05], "monitoring" [F=2.408, p<.05] "problem solving confidence" [F=2.417, p<.05], "planfulness" [F=2.930, p<.05], and the entire scale [F=5.192, p<.05] are seen to differ significantly based on department. The source of the difference observed between the groups was examined with Tukey HSD from Post-Hoc tests. According to the results of Tukey HSD test conducted to determine which groups have the significant difference, it is in favor of science pre-service teachers among the all branches.

Problem solving Skills - Department Choice Reason

Table 5 shows the results of MANOVA to determine whether the pre-service teachers' problem solving skills significantly differ based on the department choice reason variable.

Table 5. MANOVA Results of Pre-service Teachers' Problem Solving Skills Based on Department Choice Reason

Problem solving	Reason	N	M	SD	MS	df	SS	F	p
impulsive	willingfully	464	29.41	6.25	189.451	1	189.451	4.699	.030
	compulsory	359	28.44	6.47					
reflective	willingfully	464	23.08	4.42	18.115	1	18.115	.874	.350
	compulsory	359	22.78	4.71					
avoidant	willingfully	464	16.68	4.83	318.711	1	318.711	12.613	.000
	compulsory	359	15.42	5.26					
monitoring	willingfully	464	13.77	3.08	29.706	1	29.706	2.965	.085
	compulsory	359	13.39	3.26					
problem solving confidence	willingfully	464	26.39	5.07	31.685	1	31.685	1.221	.270
	compulsory	359	25.99	5.12					
planfulness	willingfully	464	18.41	3.63	29.714	1	29.714	2.194	.139
	compulsory	359	18.03	3.73					
problem solving total	willingfully	464	131.34	17.46	3123.717	1	3123.717	10.411	.001
	compulsory	359	127.42	17.13					

(λ= 0.978, F=2.601, p<.05)

It was determined that there was a significant difference in terms of department choice reason according to scores obtained from all sub dimensions and the "Problem Solving Inventory" total [Wilks Lambda (λ)= 0.978, F=2.601, p<.05]. This significant difference in terms of department choice reason variable according to scores obtained from the "impulsive" sub dimension [F=4.699, p<.05], "avoidant" sub dimension [F=12.613, p<.05] and the "Problem Solving Inventory" total [F=10.411, p<.05] in favor of pre-service teachers whose department choice reason is "willingfully".

Findings related to the third sub-problem

The analysis result of the "What is the level of pre-service teachers' curiosity?" sub-problem is given in Table 6.

Table 6. Pre-service teachers' Curiosity Levels

Curiosity	N	M	SD
breadth	823	129.13	16.00
depth	823	96.33	11.62
curiosity total	823	225.46	25.86

"Curiostiy Scale" is a 6-point Likert-type scale which is graded from "always suitable" to "never suitable". For this reason, the highest 282 and the lowest 47 points can be obtained from this 47-item scale. Obtaining 164.5 points from this scale was determined as average score. In the study, pre-service teachers' curiosity levels (M= 225.46; SD: 25.86) are seen to be above the average value.

The highest 162 and the lowest 27 points can be obtained from the "breadth" sub dimension. Obtaining 94.5 points from this sub dimension was determined as average score. In the study, pre-service teachers' curiosity levels for "breadth" sub dimension (M= 129.10; SD: 16.00) are seen to be above the average value.

The highest 120 and the lowest 20 points can be obtained from the "depth" sub dimension. Obtaining 70 points from this sub dimension was determined as average score. In the study, pre-service teachers' curiosity levels for "depth" sub dimension (M= 96.33; SD: 11.62) are seen to be above the average value.

Findings related to the fourth sub-problem

The analysis results of the "Do the pre-service teachers' curiosity levels differ significantly according to gender, grade level, department and the reason for choosing the undergraduate program they study?" sub-problem are given as headings, respectively.

Curiosity - gender

Table 7 shows the results of MANOVA to determine whether the pre-service teachers' curiosity levels significantly differ based on gender variable.

Table 7. MANOVA Results of Pre-service Teachers' Curiosity Levels Based on Gender

Curiosity	Gender	N	M	SD	MS	df	SS	F	p
breadth	Female	551	131.31	15.42	7991.634	1	7991.634	32.391	.000
	Male	272	124,69	16.27					
depth	Female	551	97.60	11.11	2664.290	1	2664.290	20.173	.000
	Male	272	93.77	12.21					
curiosity total	Female	551	228.92	24.62	19884.580	1	19884.580	30.790	.000
	Male	272	218.47	26.93					

(λ= 0.962, F=16.264, p<.05)

It was determined that there was a significant difference in terms of gender according to scores obtained all sub dimensions and the "Curiosity Scale" total [Wilks Lambda (λ)= 0.962, F=16.264, p<.05]. This significant difference in terms of gender according to scores obtained from "breadth" [F=32.391, p<.05] and "depth" sub dimension [F=20.173, p<.05] and the "Curiosity Scale" total [F=30.790, p<.05] in favor of female pre-service teachers.

Curiosity levels – grade level

Table 8 shows the results of MANOVA to determine whether the pre-service teachers' curiosity levels significantly differ based on grade level variable.

Table 8. MANOVA Results of Pre-service Teachers' Curiosity Levels Based on Grade Level

Curiosity	Grade level	N	M	SD	MS	df	SS	F	p
breadth	1st grade	404	128.42	15.65	393.591	1	393.591	1.538	.215
	4th grade	419	129.80	16.32					
depth	1st grade	404	96.23	10.88	8.979	1	8.979	.066	.797
	4th grade	419	96.43	12.30					
curiosity total	1st grade	404	224.65	24.68	521.469	1	521.469	.779	.378
	4th grade	419	226.24	26.96					

(λ= 0.997, F=1.274, p>.05)

It was determined that there was no significant difference in terms of grade level according to scores obtained from all sub dimensions and "Curiosity Scale" total [Wilks Lambda (λ)= 0.997, F=1.274, p>.05] and that the scores obtained by "Curiosity Scale" from 1st grade and 4th grade pre-service teachers were close to each other.

Curiosity – department

The result of MANOVA to determine whether the pre-service teachers' curiosity levels significantly differ based on department variable is given in Table 9.

Table 9. MANOVA Results for Pre-service Teachers' Curiosity Levels Based on Department

Curiosity	Department	N	M	SD	MS	df	SS	F	p
breadth	Science	138	127,28	15,14	295,42	6	1772,518	1,155	0,329
	Primary	151	129,82	17,93					
	Turkish	97	126,39	16,12					
	Social Sciences	86	129,48	17,49					
	English	148	130,06	13,43					
	Mathematics	80	129,62	16					
	Pre-school	123	130,8	16,03					
	Total	823	129,13	16					
depth	Science	138	93,73	11,44	217,826	6	1306,957	1,619	0,139
	Primary	151	97,04	12,1					
	Turkish	97	97,01	11,2					
	Social Sciences	86	97,88	12,73					
	English	148	96,43	10,38					
	Mathematics	80	96,01	11,94					
	Pre-school	123	96,86	11,77					
	Total	823	96,33	11,62					
Curiosity total	Science	138	221,02	25,4	751,442	6	4508,653	1,124	346
	Primary	151	226,86	28,16					
	Turkish	97	223,4	25,46					
	Social Sciences	86	227,37	28,82					
	English	148	226,5	21,56					
	Mathematics	80	225,63	25,96					
	Pre-school	123	227,67	26,18					
	Total	823	225,46	25,86					

(λ= 0.970, F=2.062, p>.05)

It was determined that there was no significant difference in terms of department according to scores obtained from the "Curiosity Scale" [Wilks Lambda (λ)= 0.970, F=2.062, p>.05] and that the scores obtained by "Curiosity Scale" from pre-service teachers educating different departments were close to each other.

Curiosity - department choice reason

Table 10 shows the results of MANOVA to determine whether the pre-service teachers' curiosity levels significantly differ based on the department choice reason variable.

Table 10. MANOVA Results of Pre-service Teachers' Curiosity Levels Based on the Department Choice Reason

Curiosity	Reason	N	M	SD	MS	df	SS	F	p
breadth	willingfully	464	130.73	14.97	2725.111	1	2725.111	10.765	.001
	compulsory	359	127.06	17.03					
depth	willingfully	464	97.70	10.67	1997.420	1	1997.420	15.031	.000
	compulsory	359	94.56	12.54					
curiosity total	willingfully	464	228.43	23.69	9388.660	1	9388.660	14.256	.000
	compulsory	359	221.62	28.00					

(λ= 0.982, F=7.685, p<.05)

It was determined that there was a significant difference in terms of department choice reason according to scores obtained from all sub dimensions and the "Curiosity Scale" total [Wilks Lambda (λ)= 0.982, F=7.685, p<.05]. This significant difference in terms of department choice reason variable according to scores obtained from the "breadth" sub dimension [F=10.765, p<.05], "depth" sub dimension [F=15.031, p<.05] and the "Curiosity Scale" total [F=14.256, p<.05] in favor of pre-service teachers whose department choice reason is "willingfully".

Findings related to the fifth sub-problem

The analysis result of the "What is the relationship among the pre-service teachers' problem solving skills and curiosity levels?" sub-problem is given in Table 11.

Table 11. The Relationship Among the Pre-service Teachers' Problem Solving Skills and Curiosity Levels

		Problem solving skills	Curiosity
Problem solving skills	**r**	1	,513**
	p		0
	N	823	823
curiosity	**r**	,513**	1
	p	0	
	N	823	823

There is a positive and medium significant relationship between the problem solving skills and the curiosity levels of pre-service teachers (r=,513, p<.01). According to this, it can be said that if there is an increase in the problem solving skills scores of the pre-service teachers, the curiosity scores will increase.

Discussion and Conclusion

As it is known, it is a prerequisite to educate individuals who are interested in science and who can think scientifically in order to follow the developments related to science and technology (Duran, 2015). Education is one of the most important investments that countries will make for the future. Education forms the basis of development. For this foundation to be sound, there is a need for individuals who think, understand, investigate, question and solve problems (Gunes, 2016). The high level of problem solving skills of the teachers is very important in determining the causes of the problems they face during and after the course, understanding and solving the problems. Based on this importance, in this study, problem solving skills of the teachers of the future, pre-service teachers were examined. The findings of the study show that the problem solving skills of the pre-service teachers are above the median value. Related with this finding, Britz (1993) also states that when teachers articulate the problems they face and discuss solutions with children, children become more aware of the significance of the problem-solving process. And also according to Piaget (1963) children understand only what they discover or invent themselves. So it is clear that, problem solving process and the problem solving skills is very important.

Pre-service teachers' problem solving skills, according to gender, only differs in the "monitoring" sub dimension and the entire scale and this significant difference is in favor of female pre-service teachers. In the study of Genc & Kalafat (2007), problem solving skills differ significantly according to gender. Nataraj & Manjula (2012) determined that problem solving skills differ significantly in terms of gender. This finding is parallel with this research finding. Tamres, Janicki & Helgeson (2002) concluded in their research that girls have more strategies and skills to solve problems than boys. Aylar & Aksin (2011), Dundar (2009) and Genc & Kalafat (2010) concluded that problem solving skills did not

differ significantly according to gender. When the research findings are examined according to the grade level, the problem solving skills of the pre-service teachers do not show a significant difference according to the grade level. In Altuncekic, Yaman & Koray (2005) and Genc & Kalafat (2010), problem solving skills did not significantly differ according to the grade level. It is a surprising fact that the problem solving skills of 1th grade pre-service teachers and 4th grade pre-service teachers do not differ according to the grade level and problem solving skills do not increase as a result of their education. But Tumkaya & Iflazoglu (2000) found a significant difference between the problem solving skills of pre-service teachers in terms of grade level. According to the department variable, the problem solving skills of pre-service teachers differ significantly. When the findings are examined, science teachers have higher problem solving skills. Genc & Kalafat (2007) and Genc & Kalafat (2010) concluded that primary pre-service teachers have high problem-solving skills. The research findings contradict with the research findings at hand. The reason why science pre-service teachers' problem solving skills are higher than pre-service teachers in other branches may be the content of compulsory and elective courses that they take in the undergraduate program. Also experiment, observations and inquiry in the lessons are very important for science instruction. And the other reason can be the individual, who is aware of the problem, is able to specify the difficulty or the source of the conflict which causes the problematic situation, is capable to deal with the problem. This is an individual difference. As Dostal (2015) stated that, perceptibility of the problem and the willingness to deal with the problemis also important to have high problem solving skills. If the individual is perceives the problem, the willingness to deal with the problem is very essential. This is a state when the individual approaches the evaluation of the circumstances of the problem and character of the problematic situation. He/she evaluates the particular circumstances and he/she attaches a particular importance to them. One of the opini ons is that he/she is not willing to deal with the problem in the current situation or to proceed to its solution. This is very important in the educational field because the problems that are given to the pupils should be the ones that the pupils accept willingly and if not, the pupils should be motivated. So findings in terms of department choice reason can be related with these statements.

While looking at the findings in terms of curiosity, pre-service teachers' curiosity levels are above the median value. It is very important for individuals to be curious. Although the curiosity was thought to be related to concepts such as amazement, fascination, interest, rarity at the beginning of the modern age, it is actually a desire to research, examine and gather information about new and interesting things (Kurtbas, 2011). There are studies on curiosity which is important for both students and teachers. In this study, it was determined that the curiosity levels of the pre-service teachers were above the median value. According to Britz (1993) teacher must be willing to become a learner, too. By being curious, observing, listening, and questioning, the teacher shares and models the qualities that are valued and promoted by the problem-solving process.

Demirel and Diker Coskun (2009) also found that individuals' curiosity levels were above the median value. In the study conducted by Aldan Karademir, Cayli and Deveci (2016), questioning skills and curiosity levels of pre-service teachers were examined. Pre-service teachers' curiosity levels were found to be above the mean value. The findings of the present study are in line with the research findings. In terms of gender, it was found that there were significant differences in favor of female pre-service teachers in both sub dimensions and scale. In the study conducted by Deringol et al. (2010), the curiosity levels of primary school pre-service teachers are in favor of females by gender. This finding is in parallel with the present research findings. In Demirel and Diker Coskun's (2009) study, a significant difference was found in favor of male pre-service teachers. Acun et al. (2013) conducted the adaptation of "Curiosity and Exploration Scale II" to Turkish for university students. According to gender, university students' curiosity levels are in favor of males. And the curiosity levels were also determined in terms of grade level findings show that there was no significant difference in terms of grade level according to scores obtained from all sub dimensions and "Curiosity Scale" total. One of the opinions regarding curiosity often expressed is that almost all young chil- dren are highly curious but they seem to lose this characteristic very soon after they enter school. If this is true-and there is very little empirical evidence on which to either accept or reject the opinion-it does not explain why some children and some adults seem to retain a very high level of curiosity (Maw & Maw, 1966). When examined in terms of the department, the curiosity of pre-service teachers does not differ significantly. This finding is similar in the study conducted by Deringol et al. (2010). In this research, correlation between pre-service teachers' problem solving skills and the curiosity levels were also investigated. Findings showed that there was a meaningful positive and medium correlation between them. As stated in the literature, curious people are good problem solvers. So high correlation can be expected between the problem solving skills and the curiosity levels. But this result can be because of pre-service teachers' custom lives or family attitudes. Therefore, it is reasonable to examine an area of living which to varying degrees is universal to almost all children, namely, the family, for influences on curiosity. It is conceivable that some types of family life may tend to accentuate curiosity, while other types may tend to retard or restrict curiosity (Maw & Maw, 1966). Based on the research findings, the following suggestions are presented.

1. Different compulsory or elective lessons can be added to the curriculum and activities supporting the problem solving process can be used to improve the problem solving skills.

2. Qualitative researches using different techniques (interview, observation…) can be designed to investigate the reasons of non differentiation in terms of grade level.

3. A longitudinal study can be designed to determine the reasons changes in problem solving skills and curiosity levels.

4. This research is structured on the problem solving skills and curiosity levels. Also other participant groups and different variables can be added and results can be compared.

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