



JER

Osmangazi Journal of Educational Research © OJER Volume 5, Number 1, Spring 2018

Research Article

To cite this article: Balbağ, M. Z. and Karademir, E. (2018). Examining Preservice Social Studies Teachers' Views about the Nature of Science by Different Variables. *Osmangazi Journal of Educational Research (OJER)*, 5(1), 35–45. Retrieved from <http://ojer.ogu.edu.tr/Storage/OsmangaziJournalOfEducationalResearch/Uploads/OJER-V5-N1-3.pdf>

Submitted: June 28, 2018

Revised: July 2, 2018

Accepted: July 3, 2018

Examining Preservice Social Studies Teachers' Views about the Nature of Science by Different Variables*

Mustafa Zafer Balbağ¹

Eskişehir Osmangazi University, Eskişehir, TURKEY

Ersin Karademir²

Eskişehir Osmangazi University, Eskişehir, TURKEY

Abstract

This study aims to examine preservice social studies teachers' views about the nature of science by different variables (gender, grade level, academic success, type of graduated high school, and status of taking courses on the nature of science and history of science). The general survey model was used in the study. The study sample consisted of 290 preservice social studies teachers studying in the faculties of educational sciences at three different state universities during the spring semester of 2016-2017 academic year. Data were collected using the nature of science scale developed by Özgelen (2013). The Cronbach's alpha reliability coefficient for the entire scale is .83. The Cronbach's alpha reliability coefficient obtained for this study is .76. Data were analyzed and interpreted using SPSS package program, and suggestions were developed in line with the results obtained.

Keywords

Social Studies, Preservice Teacher, Nature of Science.

The way of understanding the laws of order established in our world passes through understanding and enhancing the science. In this sense, the question of what science comes into prominence. According to Topdemir and Unat (2009), science is an intellectual occupation that finds out the causes of and interaction between phenomena occurring in the nature, generalizes and theorizes these phenomena, and predicts how

*A part of this study was presented as an oral presentation at the International Symposium on Social Studies Education VI (USBES VI) organized by Anadolu University between 4 and 6 May 2017.

¹Assoc. Prof., Department of Mathematics and Science Education, Eskişehir Osmangazi University, Faculty of Education, zbalbag[at]ogu.edu.tr

²Assis. Prof., Department of Mathematics and Science Education, Eskişehir Osmangazi University, Faculty of Education, ekarademir[at]ogu.edu.tr

and when the future events will happen using this theoretical knowledge. The significant scientific developments occurred over time have also accelerated the efforts for understanding the nature of science. When it comes to answer the question of what the nature of science is; the science, as a way of knowing, is often expressed as the values and beliefs at the root of scientific knowledge or the development of scientific knowledge (Flick and Lederman, 2006). Understanding the nature of science provides students and the public with an ability to make conscious decisions about conscious science consumerism, scientific claims and information (Lederman, 1999). According to Ekiz et al. (2007), it is important for all individuals to understand the nature of science; and when those who do not understand the nature of science encounter any research contradicting with scientific knowledge and well-accepted studies, they may hesitate and accept it without questioning.

Knowledge of the nature of science refers to a field where history of science, philosophy of science, sociology of science, and psychology of science intersect (Köseoğlu et al., 2008). Therefore, the nature of science is related to many social sciences as well as to the social studies fed by social sciences. Knowing about the nature of science will help preservice social science teachers gain a scientific view, question social values, use critical approaches, and produce quality course content (Can, 2008; Öztürk and Dilek, 2002).

Çınar and Köksal (2013) report that courses on science and nature of science have been offered to preservice social science teachers studying at the faculties of education in Turkey since 2006-2007 academic year, and that preservice teachers can gain basic insights and knowledge about the nature of science in these courses and thus share these knowledge with their students after graduation.

Studies report a close relationship between the nature of science and science literacy (Derman, 2014; Tunç Şahin and Say, 2010; Katılmış et al., 2010). Because the most important feature of a science literate individual is accepted to have sufficient understanding of the nature of science (Çepni, 2011).

Scientific literacy is an important concept to be emphasized for social studies in the context of educating good citizens for a democratic society (Tunç Sahin and Say, 2010). The general aim of social studies is to raise effective and democratic citizens. Accordingly, it is necessary for these citizens to understand human and life information, gain scientific perspective, use critical approaches, question the existing social values, produce new values, and thus turn into creative individuals (Öztürk and Dilek, 2002). In this sense, determining preservice social studies teachers' views about the nature of science will also allow us to have an idea about their scientific literacy. The views of preservice social studies teachers, who will give social science lessons in the future and play an effective role in terms of educational activities, are important in this respect. In addition, this study will also be important in terms of providing data and commenting on the nature of science.

In the light of all mentioned above, this study aims to examine preservice social studies teachers' views about the nature of science by different variables (gender, grade level, academic success, type of graduated high school, and status of taking courses on the nature of science and history of science). The general screening model was used in the study. In line of this main purpose, answers for the following questions were sought:

- What are preservice social science teachers' views about the nature of science?
- How does preservice social science teachers' views on the nature of science vary by gender?

- How does preservice social science teachers' views on the nature of science vary by grade level?
- How does preservice social science teachers' views on the nature of science vary by academic success?
- How does preservice social science teachers' views on the nature of science vary by type of graduated high school?
- How does preservice social science teachers' views on the nature of science vary by status of taking courses on the nature of science and history of science?

Participants

The study sample consisted of 290 first, second, third and fourth grade preservice social studies teachers studying in the faculties of educational sciences at three different state universities during the spring semester of 2016-2017 academic year. Participants' characteristics were presented in Table 1.

Table 1

Participants' characteristics

Participants		n	%
Gender	Male	140	48.3
	Female	150	51.7
General academic average	0-1.99	28	9.7
	2.00-2.99	151	52.1
	3.00-4.00	111	38.3
Type of graduated high school	General High School	161	55.5
	Anatolia H. S.	48	16.6
	Vocational H. S.	51	17.6
	Other	30	10.3
Grade	1st grade	72	24.8
	2nd grade	70	24.1
	3rd grade	77	26.6
	4th grade	71	24.5
Has the participant taken course(s) on the nature of science and history of science	Yes	96	33.1
	No	194	66.9

Method

Survey model from quantitative research methods was used in this study. Survey models are research approaches aimed at describing past or present situations as they exist, and attempt to define events, individuals or objects under investigation within their own circumstances and as they exist (Karasar, 1999).

Data Collection Tool

Data were collected using the nature of science scale developed by Özgelen (2013). The scale is a four-point Likert type scale with five factors, 19 items and options of "I definitely agree, I mostly agree, I partially agree, I definitely disagree". The Cronbach's alpha values for the scale and this study were presented in Table 2.

Table 2.

Nature of Science Scale Cronbach's Alpha Values

Nature of Science Scale	Cronbach's Alpha Value for the Scale	Cronbach's Alpha Value for this Study
Factor 1: Characteristics of scientific knowledge and scientist (items; 1, 2, 5, 6, 7, 13, 14, 18, and 19)	.82	.79
Factor 2: Openness to change (items; 10, 11, and 12)	.63	.70
Factor 3: Subjectivity in science and technology (items; 3, 4, and 8)	.50	.72
Factor 4: Social cultural and structure (items; 9 and 17)	.53	.80
Factor 5: Importance of theories in science (items 15 and 16)	.43	.64
Total	.83	.76

Data Analysis

Arithmetic mean and standard deviation values were examined in determining the preservice social science teachers' views on the nature of science. SPSS package program was used in data analysis. The normality of distribution of research data was tested. In addition, the normality of distribution of variables were taken into consideration to use parametric or nonparametric tests. Since the data showed normal distribution, appropriate parametric tests were used. The t test was used to determine whether the preservice social science teachers' views on the nature of science vary by gender and status of taking courses on nature of science and history of science, and the one way analysis of variance

(ANOVA) was used to determine whether the preservice social science teachers' views on the nature of science vary by grade level, academic success, and type of graduated high school.

Results

Descriptive statistics of this study, in which preservice social studies teachers' views about the nature of science were examined in terms of some variables, were presented in Table 3.

Table 3.

Descriptive Statistics of Preservice Social Studies Teachers' Views about the Nature of Science

Nature of Science Scale Items	n	Minimum	Maximum	Mean	Standard Deviation
M1. It is inevitable that two scientists, who make the same observation, make similar deductions	290	1.00	4.00	2.54	0.952
M2. Scientific laws fully explain the facts about the universe.	290	1.00	4.00	2.70	0.859
M3. Studies of scientists are influenced by their own ideas about the same subject.	290	1.00	4.00	2.67	0.861
M4. Imagination is utilized while creating scientific knowledge.	290	1.00	4.00	2.30	1.053
M5. Scientific models (such as solar system and atomic model) are a complete replica of the reality.	290	1.00	4.00	2.55	0.933
M6. Science is the sum of researches that scientists do using only scientific	290	1.00	4.00	2.45	1.042

methods.						
M7.Scientific theories gradually become scientific laws.	290	1.00	4.00	2.31	0.901	
M8.Technology is the field of application of theoretical science.	290	1.00	4.00	2.86	0.916	
M9.Social and cultural values have no effect on formation of the science.	290	1.00	4.00	3.11	1.055	
M10.Scientific information changes over time.	290	1.00	4.00	3.11	0.989	
M11.Scientific method is fixed and does not change.	290	1.00	4.00	3.17	1.048	
M12.Scientific laws never change.	290	1.00	4.00	3.31	1.001	
M13.Scientific knowledge is proven precisely through repeatable experiments.	290	1.00	4.00	2.24	0.979	
M14.All scientists continue to work completely free of prejudices.	290	1.00	4.00	2.60	1.021	
M15.Science is a person's effort to understand and explain the universe using different methods.	290	1.00	4.00	3.26	0.818	
M16.Scientists are influenced by previous relevant theories when researching a subject.	290	1.00	4.00	3.12	0.804	
M17.Scientific questions and methods vary according to historical-cultural and social situations.	290	1.00	4.00	2.70	0.989	
M18.Scientific knowledge is created only as a result of experiments and objective observations.	290	1.00	4.00	2.27	0.997	
M19.Science answers all questions.	290	1.00	4.00	2.93	0.966	

Participants' mean scores on 13 of the 19 items in the scale, which aims to determine the preservice social science teachers' views on the nature of science, were found to vary between two and three, and participants' mean scores on the remaining 6 items were found to vary between three and four. The items with the highest scores were the 12th and 15th items, whereas the items with the lowest scores were the 13th and 18th items. Accordingly, participants' mean score on the entire scale was 2.74 out of 4 points, which indicated that they had generally positive views about the nature of science and obtained a mean score above the average.

Table 4 shows the t-test results for preservice social studies teachers' views about the nature of science by gender.

Table 4.

T-Test Results for Preservice Social Studies Teachers' Views about the Nature of Science by Gender

Gender	n	X _{mean}	s	t	sd	p	Differentiation	
Factor1	Male	140	22.01	4.703	-	288	.042	There is a difference in favor of women
	Female	150	23.13	4.639				
Factor2	Male	140	9.50	2.352	-.631	288	.529	No difference
	Female	150	9.67	2.324				
Factor3	Male	140	8.02	1.707	1.801	288	.073	No difference
	Female	150	7.65	1.829				
Factor4	Male	140	5.81	1.493	.003	288	.998	No difference

	Female	150	5.81	1.487				
Factor5	Male	140	6.41	1.275	.434	288	.665	No difference
	Female	150	6.35	1.371				
Total	Male	140	51.75	6.328	-	288	.265	No difference
	Female	150	52.60	6.616				

As seen in Table 4, there was no significant difference in the second, third, fourth and fifth factors and total scale by gender. The significant difference was only found in the first factor (the characteristics of scientific knowledge and scientists) ($p < .05$). This difference was in favor of the preservice female teachers.

Table 5 shows the ANOVA-test results for preservice social studies teachers' views about the nature of science by their grade levels.

Table 5

ANOVA -Test Results for Preservice Social Studies Teachers' Views about Nature of Science by Grade Level

Grade Level		Sum of squares	sd	Mean of squares	F	p	Differentiation
Factor1	Between-groups	119.906	3	39.969	1.828	.142	No difference
	In-group	6252.438	286	21.862			
	Total	6372.345	289				
Factor2	Between-groups	35.706	3	11.902	2.210	.087	No difference
	In-group	1540.463	286	5.386			
	Total	1576.169	289				
Factor3	Between-groups	19.718	3	6.573	2.103	.100	No difference
	In-group	893.661	286	3.125			
	Total	913.379	289				
Factor4	Between-groups	6.357	3	2.119	.958	.413	No difference
	In-group	632.829	286	2.213			
	Total	639.186	289				
Factor5	Between-groups	3.994	3	1.331	.758	.518	No difference
	In-group	502.282	286	1.756			
	Total	506.276	289				
Total	Between-groups	372.084	3	124.028	3.014	.030	There is a difference between 1 st and 2 nd grades in favor of 2 nd grades There is a difference between 1 st and 4 th grades in favor of 4 th grades
	In-group	11768.485	286	41.149			
	Total	12140.569	289				

As seen in Table 5, no significant difference was found in any of the factors by grade level. The significant difference was found only in total scale ($p < .05$). These

differences were between the 1st and 2nd grades in favor of the 2nd grades; and also between the 1st and 4th grades in favor of the 4th grades.

Table 6 shows the ANOVA-test results for preservice social studies teachers' views about the nature of science by academic success.

Table 6

ANOVA -Test Results for Preservice Social Studies Teachers' Views about Nature of Science by Academic Success Levels

Academic Success		Sum of squares	sd	Mean of squares	F	p	Differentiation
Factor1	Between-groups	151,632	2	75,816	3,498	,032	There is a difference between two and three in favor of three
	In-group	6220,713	287	21,675			
	Total	6372,345	289				
Factor2	Between-groups	68,579	2	34,289	6,528	,002	There is a difference between one and three in favor of three There is a difference between two and three in favor of two
	In-group	1507,590	287	5,253			
	Total	1576,169	289				
Factor3	Between-groups	,402	2	,201	,063	,939	No difference
	In-group	912,977	287	3,181			
	Total	913,379	289				
Factor4	Between-groups	13,859	2	6,929	3,180	,043	There is a difference between two and three in favor of three
	In-group	625,327	287	2,179			
	Total	639,186	289				
Factor5	Between-groups	7,586	2	3,793	2,183	,115	No difference
	In-group	498,690	287	1,738			
	Total	506,276	289				
Total	Between-groups	683,526	2	341,763	8,561	,000	There is a difference between one and three in favor of three There is a difference between two and three in favor of three
	In-group	11457,043	287	39,920			
	Total	12140,569	289				

One: 0-1.99 Two:2.00-2.99 Three:3.00 and over

As seen in Table 6, there was no significant difference between the second and fifth factors by academic success. The significant difference was found in the first, second, fourth factors and total scale ($p < .05$). For the first factor, these differences were

between 3 and 2 in favor of 3; for the second factor between 3 and 1 in favor of 3; for the third factor between 2 and 3 in favor of 2; for the fourth factor between 3 and 2 in favor of 3; for the total scale between 3 and 1 in favor of 3 and between 3 and 2 in favor of 3.

Table 7 shows the ANOVA-test results for preservice social studies teachers' views about the nature of science by type of graduated high school.

Table 7

ANOVA -Test Results for Preservice Social Studies Teachers' Views about Nature of Science by Type of Graduated High School

Type of graduated high school		Sum of squares	sd	Mean of squares	F	p	Differentiation
Factor1	Between-groups	73,862	3	24,621	1,118	,342	No difference
	In-group	6298,482	286	22,023			
	Total	6372,345	289				
Factor2	Between-groups	24,711	3	8,237	1,518	,210	No difference
	In-group	1551,458	286	5,425			
	Total	1576,169	289				
Factor3	Between-groups	12,280	3	4,093	1,299	,275	No difference
	In-group	901,099	286	3,151			
	Total	913,379	289				
Factor4	Between-groups	5,779	3	1,926	,870	,457	No difference
	In-group	633,407	286	2,215			
	Total	639,186	289				
Factor5	Between-groups	12,051	3	4,017	2,325	,075	No difference
	In-group	494,225	286	1,728			
	Total	506,276	289				
Total	Between-groups	210,237	3	70,079	1,680	,171	No difference
	In-group	11930,331	286	41,714			
	Total	12140,569	289				

As seen in Table 7, no significant difference was found in any of the factors and total scale by type of graduated high school.

Table 8 shows the ANOVA-test results for preservice social studies teachers' views about the nature of science by course taking status.

Table 8.

ANOVA -Test Results for Preservice Social Studies Teachers' Views about Nature of Science by Course Taking Status

Has the participant taken a course on Taking Status	n	X _{mean}	s	t	sd	p	Differentiation
Factor1 Yes	96	22.00	5.091	-	288	.135	No difference

					1.499			
	No	194	22.88	4.473				
Factor2	Yes	96	9.73	2.245	.715	288	.475	No difference
	No	194	9.52	2.381				
Factor3	Yes	96	8.33	1.804	3.473	288	.001	There is a difference in favor of those who has taken the course
	No	194	7.58	1.715				
Factor4	Yes	96	6.06	1.548	2.071	288	.039	There is a difference in favor of those who has taken the course
	No	194	5.68	1.444				
Factor5	Yes	96	6.50	1.353	1.093	288	.275	No difference
	No	194	6.32	1.308				
Total	Yes	96	52.63	6.919	.804	288	.422	No difference
	No	194	51.97	6.261				

As seen in Table 8, there was no significant difference in the first, second and fifth factors and total scale by status of taking courses on the nature of science and history of science. The significant difference was found only in the third (subjectivity in science and technology) and fourth (social and cultural structure) factors ($p < .05$). This difference found in both factors was in favor of the preservice teachers who have taken the course.

Conclusion and Discussion

This study found that participant preservice social studies teachers had generally positive views about the nature of science and obtained a mean score above the average. Köksal and Çınar (2013) conducted a study to determine the preservice social studies teachers' views about the nature of science, and found that participants could explain the characteristics of science and scientific knowledge, had a viewpoint of the nature of science, and exemplified the influence of society on science. This result supports the results of the present study. However, the same study reported that preservice social studies teachers had difficulty in defining the concepts of the nature of science and had conceptual misconceptions about the difference between scientific models, theory and law.

No significant difference was found in the second, third, fourth and fifth factors and total scale by gender. The significant difference was only found in the first factor. This difference was in favor of the preservice female teachers.

No significant difference was found in the first, second and fifth factors and total scale by status of taking courses on the nature of science and history of science. The significant difference was found only in the third and fourth factors. This difference found in both factors was in favor of the preservice teachers who have taken the course. Taking courses on the nature of science and history of science can be said to positively

affect subjectivity in science and technology in the third factor and social and cultural structure in the fourth factor.

No significant difference was found in any of the factors by grade level. The significant difference was found only in the total scale ($p < .05$). These difference was between the 1st and 2nd grades in favor of the 2nd grades; and also between the 1st and 4th grades in favor of the 4th grades. Accordingly, preservice social studies teachers' views about the nature of science were significant in favor of the preservice teachers studying in upper classes. This significance in favor of upper classes may suggest that preservice social studies teachers' views about the science and nature of science are positively affected as they progress in undergraduate education.

No significant difference was found in the second and fifth factors by academic success. The significant difference was found in the first, second, fourth factors and total scale ($p < .05$). For the first factor, these differences were between 3 and 2 in favor of 3; for the second factor between 3 and 1 in favor of 3; for the third factor between 2 and 3 in favor of 2; for the fourth factor between 3 and 2 in favor of 3; for the total scale between 3 and 1 in favor of 3 and between 3 and 2 in favor of 3. This result may suggest that an increase in academic success of preservice social studies teachers has generally a positive effect on their views about the nature of science.

No significant difference was found in any of the factors and total scale by type of graduated high school. This result suggests that type of graduated high school does not affect preservice social studies teachers' views about the nature of science.

Studies about the nature of science are generally conducted regarding science, and there is no adequate number of studies in the field of social studies. Therefore, the comparison of the results with the literature has been limited.

Suggestions

According to the results of this study, the following suggestions can be made:

1. The reasons underlying the results of this study can be examined in detail conducting a qualitative study.
2. The relationship between preservice teachers' views about the nature of science and scientific literacy can be examined in detail.
3. This study can be repeated using teachers and preservice teachers in different areas.

References

- Can, B. (2008). *İlköğretim öğrencilerinin bilimin doğası ile ilgili anlayışlarını etkileyen faktörler*. Doktora Tezi, Dokuz Eylül Üniversitesi Eğitim Bilimleri Enstitüsü, İzmir.
- Çepni, S. (2011). *Kuramdan uygulamaya fen ve teknoloji öğretimi*. Ankara: Pegem Akademi.
- Çınar, M. and Köksal, N. (2013). Sosyal bilgiler öğretmen adaylarının bilime ve bilimin doğasına yönelik görüşleri. *Mersin Üniversitesi Eğitim Fakültesi Dergisi*, 9 (2), 43-57.
- Derman, A. (2014). Bilimsel okuryazarlığın tesisinde fen öğretim programlarının rolü. *The Journal of Academic Social Science Studies (JASSS)*, 26, 143-157.

- Ekiz, D., Erözkan, A., Bozkurt, E., İnanç, H., Gelen, İ., Taşlı, İ., Gündoğdu, K., Deniz, L., Yiğit, N. and Çakıcı, Y. (2007). *Bilimsel araştırma yöntemleri*, İstanbul: Lisans Yayınları.
- Flick, L.B., and Lederman, N. G. (2006). Introduction. In L.B. Flick and N.G. Lederman (Eds.), *Scientific inquiry and nature of science* (pp. ix-xviii). Dordrecht: Springer.
- Karasar, N. (1999). *Bilimsel araştırma yöntemi*. Ankara: Nobel.
- Katılmış, A., Ekşi, H. and Öztürk, C. (2010). Sosyal bilgiler dersi kazanımlarıyla bütünleştirilmiş bilimsellik odaklı karakter eğitimi programının etkililiği [Elektronik versiyon]. *Sosyal Bilgiler Eğitimi Araştırmaları Dergisi*. 2010: 1(1), 50-87
- Köseoğlu, F., Tümay, H. and Budak, E. (2008). Bilimin doğası hakkında paradigma değişimleri ve öğretimi ile ilgili yeni anlayışlar. *Gazi Eğitim Fakültesi Dergisi*, 28 (2), 221-237.
- Lederman, N. G. (1999). Teachers' understanding of the nature of science and classroom practice: factors that facilitate or impede the relationship. *Journal of Research in Science Teaching*, 36(8), 916-929.
- Özgelen, S. (2013). Bilimin doğası ölçeğinin geliştirilmesi. *Kastamonu Eğitim Dergisi*, 21 (2), 711-736
- Öztürk, C. and Dilek D. (2002). *Hayat bilgisi ve sosyal bilgiler öğretimi*. Ankara: Pegem Yayıncılık.
- Topdemir, H. G. and Unat, Y. (2009). *Bilim tarihi* (2. Baskı). Ankara: Pegem Akademi.
- Tunç Şahin, C. and Say, Ö. (2010). İlköğretim öğrencilerinin bilimsel okuryazarlık düzeylerinin incelenmesi. *ZKÜ Sosyal Bilimler Dergisi*, 6 (11), 223-240.

Biographical Statements

Mustafa Zafer BALBAĞ is faculty member at Eskişehir Osmangazi University, Faculty of Education, Department of Mathematics and Science Education. He also work as a vice chair in the same department. He has been a board member of the faculty for two years. He has studies on Science and Physics Education.

Ersin KARADEMİR completed his doctorate in the field of science education in Hacettepe University. He is currently a faculty member in the Department of Mathematics and Science Education at the Faculty of Education in Eskişehir Osmangazi University. He has articles, papers, projects etc. in international academic journals. Research fields; science education, out-of-school learning, educational statistics, interdisciplinary education and skills.