TÜRK FEN EĞİTİMİ DERGİSİ
Yıl 10, Sayı 1, Mart 2013

Journal of
TURKISH SCIENCE EDUCATION
Volume 10, Issue 1, March 2013

http://www.tused.org

Survey of the Science and Primary School Teachers Candidates' Scientific Attitudes in Terms of Multi-Variables

Adem TAŞDEMİR[1], Tezcan KARTAL[2]

[1] Assist.Prof.Dr., Ahi Evran University, Faculty of Education, Kırşehir-TURKEY
[2] Research Assistant, Ahi Evran University, Faculty of Education, Kırşehir -TURKEY

Received: 28.07.2011 **Revised:** 03.01.2013 **Accepted:** 15.01.2013

The original language of article is English (v.10, n.1, March 2013, pp.44-55)

ABSTRACT

This study was aimed to examine the effects of variables on scientific attitudes of teacher candidates. For this purpose, science and primary school teacher candidates were included in terms of their scientific attitudes which were considered as being contradictory to each other's attitudes and being purposive cases. Survey was a descriptive one in which science and primary school teacher candidates' scientific attitudes were considered as a fact and during the study process. The sample group consists of randomly selected 1st, 2nd, 3rd and 4th primary school teacher candidates studying at the Department of Grade Teachers and Science Teachers at the Education Faculty of Ahi Evran University in 2009-2010 academic years. The data was collected by using three different methods. At the first stage, "Scientific Attitude Inventory" was used. At the second stage, "Learning Style Inventory" was used to assess the learning style of the teacher candidates. The transcript averages obtained from the Student Affairs Department indicating the academic achievements of the teacher candidates up to their current year were used at the third stage. According to the results of the research, it was found out that the scientific attitudes of the teacher candidates were significantly in favor of the science teachers according to gender, grade level at the university, high schools which they graduated from and their learning style (accomodator, converger and assimilator). However, when scientific attitudes were examined according to learning styles, the differences between the groups were observed to be statistically insignificant for the diverger learning styles.

Key Words: Scientific Attitude; Multi-Variables; Science And Primary School Teachers' Candidates.

INTRODUCTION

In this day and age in which knowledge increases exponentially and the purpose is not to give the knowledge to the student, but to let the student understand and comprehend the knowledge and to correlate in order to produce the knowledge by himself when it is needed (Tatar, 2006), because we see that children are natural researchers when we study their growing processes (Ertem, 2007). Science also supports the growing stage of the children.

Corresponding Author email: atasdemmir@gmail.com

Science assumes that there is a reason for everything, and it is one of the functions of the educators to help the child to accommodate by using his intellectual powers to solve the problems of a changing reality with which he is continually faced (Tait, 1981). Instruction that makes science more exciting and encourages students (e.g., laboratory) has a positive influence on students' attitude towards science and their achievement (Freedman, 1997).

Science education, on the other hand, is the process of teaching children the skills necessary to understand nature and natural phenomenon (Bahadır, 2007). Science education does contribute not only to the student's cognitive skills but also to affective learning abilities (Demirbaş, 2005). This is the reason why students should not be instructed to memorize the information taught in the Science class, but should be guided to improve their attitudes and intellectual processing abilities necessary to understand and solve the problems involving science which they face in everyday life. (Demirbaş & Yağbasan, 2006). One of the main goals of the new programme is to teach students the scientific processing skills, understanding of technology, society and environment, and scientific attitudes and principles along with teaching the basic scientific concepts. Therefore, Science and Technology Education Program does not consider obtaining knowledge, and teaching students the scientific attitudes and principles is one of its primary objectives. The positive scientific attitude and principles taught by this programme will have an effect on their subsequent learning experience of Science and Technology (Balım, Sucuoğlu & Aydın, 2009). Science educators have been struggling with defining science attitudes (Shrigley, Koballa & Simpson, 1988 as cited in Moore & Foy, 1997). The importance of the scientific attitude in science education is based, in part, on the claim that the behavior of the scientists (and of the scholars in general) is substantially motivated by this attitude and a large amount of research in science education literature has been devoted to deriving a conception of the scientific attitude from the writings of scientists, philosophers of science and science educators (Gauld, 1982).

It is now generally acknowledged in literature that science related attitudes mentioned in such goal statements do not form a single one-dimensional construct (Jonns & Butts, 1983). Therefore, scientific attitudes can be regarded as a complex of "values and norms which is held to be binding on the man of science. The norms are expressed in the forms of prescriptions, proscriptions, preferences and permissions. They are legitimatized in terms of institutional values" (Singh, 1981).

According to Ergin and Özgürol (2011), scientific attitudes are positive approaches towards inquisitive thinking which makes transferring problem solving, information-producing, in short, and technical research proficiencies to implementation. The scientific attitude is not only for research or learning; it is also one of the indispensable qualities of democratic life.

Çilenti (1988) points out that scientist must possess ways to obtain knowledge and the scientific processing skills in order to create new knowledge by improving an old knowledge. The scientific attitudes that should be acquired include curiosity, modesty, open-mindedness, skepticism and not giving up in case of failure and integrity.

Scientific literacy and attitudes towards science play an important role in humans' daily lives (Chin, 2005). Counteract the existing decline in interest and to motivate adolescents to pursue science in higher education, it is important to investigate situational factors that might spark or hold students' interest in science topics as well as their interest in working scientifically (Hollsterman, Grube & Bögeholz, 2010). Also scientific attitudes have an important role in developing scientific literacy (Yaşar & Anagün, 2009). Therefore, learning science is also effective in the development of scientific attitudes of students (Hamurcu, 2002). Also, making provisions can be considered as one of the styles which can reveal the factors that would improve scientific attitudes. For example, learning styles can be described

as characteristic features and preferences of student's perception and interaction of his environment and how he reacts against it (Usta et al., 2011). Revealing the relation between learning styles and scientific attitudes while considering the effect of learning on scientific attitudes, these attitudes can be improved.

According to Azizoğlu and Çetin (2009), knowing student's learning styles, their attitudes towards science and motivations are crucial for planning of science teaching. Individuals differ in learning styles, motivation and attitudes towards classes and this causes them to have different scientific skills at different levels.

Although, in this study, determining factors that can have an influence upon teacher candidates' scientific attitudes (demographic factors, academic success, learning styles) are aimed to be identified and scientific attitudes of school and science teachers' are described with multi-variables . In this context, these questions below are answered:

According to departments at which teacher candidates study;

1) What is the level of scientific attitudes of teacher candidates?
2) Do scientific attitudes of teacher candidates change to learning styles, departments, gender, grade levels, the high schools they graduated and accommodation units?
3) Is there a relationship between scientific attitudes and academic achievements?

METHODOLOGY

Descriptive method was used in this research. In this research, scientific attitudes of primary school and science teachers are considered as a fact, and these facts are described via correlations one by one. Factors related to events, individuals, groups, subjects, units and cases are described separately. Considering relations between present and earlier events and cases, descriptive researches aims to explain interactions between conditions. Besides, in this research, the scientific attitudes of science and school teachers have been accepted as phenomena, and these phenomena are linked to, correlated to each other through a great many descriptions (Cohen, Manion & Morrison, 2000; Muijs, 2004).

a) Sample Group

Sample group consists of 1st, 2nd, 3rd and 4th grade teacher candidates randomly chosen from the department of science and primary school teacher at Ahi Evran University during 2009-2010 education years. Groups that are included in this research were chosen in terms of purposive sampling. In this context, science and primary school teacher candidates are included in terms of their scientific attitudes which are considered as being contradictory to each other's attitudes and being purposive cases.

Study groups were created according to total number of students in departments because both science and primary school teacher departments have majored different numbers teacher candidates. In this context, there are approximately 720 students in the primary school teacher departments, and approximately 480 students in the science teacher departments. According to Çıngı (1994) a study group of 500 students can be carry out with at least 218 students within the amount of deviation from 0.05 and 0.05 significance level. Study group in this research has 236 science teacher and 323 primary school teacher candidates. In this sense the sample size befit. Distribution of teacher candidates in sample group according to their departments and gender is given in Table 1.

Table 1. *Distribution of Teacher Candidates in Sample Group According to Their Departments*

Classes	*Science Teacher*		*Primary school teacher*		*Total*	
	Female	*Male*	*Female*	*Male*	*Female*	*Male*
	n	*n*	*n*	*n*	*n*	*n*
1. grade	43	25	66	26	109	51
2. grade	32	29	94	39	126	68
3. grade	47	12	30	23	77	35
4. grade	31	17	30	15	61	32
Total	153	83	220	103	373	186

b) Data Collection Tools

The data were collected using three different methods. At the first stage, "Scientific Attitude Inventory" was used, which was developed by Moore and Foy (1997) to assess the science attitudes of the teacher candidates and adapted to Turkish by Demirbaş (2005). At the second stage, "Learning Style Inventory" was used, which was developed by Kolb (1985) to assess the learning style of the teacher candidates and was adapted to Turkish by Aşkar and Akkoyunlu (1993). Cronbach Alpha reliability coefficient of the scientific attitude scale is calculated as 0.76, and the Learning Style Inventory is 0,80. The transcript averages obtained from Student Affairs Department of Ahi Evran University indicating the academic achievements of the teacher candidates were used in the third stage. For example, the GPA (grade point average) for a total of 7 semesters and 58 courses of the 4th grade teacher candidates, and the GPA for a total of 5 semesters and 43 courses of the 3rd grade teacher candidates were collected for the research. In this context, the final GPAs were obtained via university archive documents showing the achievement status of the overall academic year. Also, the "Personal Information Forms" were used in order to determine the demographic attributes.

c) Data Analysis

Using SPSS 15.0 software, descriptive and explanatory statistics were used to analyze the obtained data. Before data analysis, normal distribution of data with Kolmogorov-Smirnov and Shapiro-Wilk tests was examined. If the numbers of dependents are less than 50 in study groups, data should be analyzed with Shapiro-Wilk test instead of Kolmogorov-Smirnov test (Tabachnick and Fidell, 2001). In addition Levene test was used for homogeneity of variance. If Levene test scores of data is greater than 0.05, homogeneity of variance is a normal distribution.

At the analysis phase of the data and the description process of each group variables were used and frequency (f), percentage (%), weighted mean ($\overline{X}$) and standard deviation (SD), the independent samples t-test was used to compare the scientific attitudes of the teacher candidates to the independent variables. Academic achievement of science and primary school teacher was divided in to two groups as upper and lower level by median of groups. In addition, the Effect Size (Cohen d) was analyzed in case the differences between the groups were significant. The Cohen d value is one of the effect size calculation methods used to compare the group averages (Lane, 1993).

The assessment measure used to interpret the calculated average values was generated by using the Range (array size)/ Group Number (Turgut, 1992; Arseven, 1993). In accordance with this, the assessment measure is as follow:

Given Weight	Attribute Groups	Limits
5	Strongly agree	4.20-5.00
4	Mildly agree	3.40-4.19
3	Neutral/undecided	2.60-3.39
2	Mildly disagree	1.80-2.59
1	Strongly disagree	1.00-1.79

FINDINGS

Collect data firstly was examined according to departments of teacher candidates in general. Later, relationships among different variables and scientific attitudes were investigated.

Table 2. *The Scientific Attitudes of the Teacher Candidates with Respect to Their Departments*

	Department	*N*	$\overline{X}$	*SD*	*df*	*t*	*p*
GENERAL	Primary School Teac.	323	3,36	,262	557	-10,515	,000
	Science Teacher	236	3,59	,246			
1*. The Structure of Scientific Laws and Theories (laws of science)	Primary School Teac.	323	3,23	,439	541,811	-3,971	,000
	Science Teacher	236	3,37	,379			
2. The Structure of Sciences and its Approach to Events (scientific explanation)	Primary School Teac.	323	3,87	,498	557	2,233	,026
	Science Teacher	236	3,78	,441			
3. The Presentation of Scientific Behavior (manner of scientific observation)	Primary School Teac.	323	3,83	,502	557	-3,068	,002
	Science Teacher	236	3,95	,451			
4. The Structure and Purpose of Sciences (value of scientific activities)	Primary School Teac.	323	3,00	,418	557	-1,274	,203
	Science Teacher	236	3,04	,346			
5. The Place and Importance of Sciences in Society (usefulness of science to society)	Primary School Teac.	323	3,46	,537	557	-5,230	,000
	Science Teacher	236	3,70	,536			
6. The Enthusiasm Towards Scientific Practice (student career aspirations)	Primary School Teac.	323	3,00	,602	557	-13,184	,000
	Science Teacher	236	3,65	,534			

* Distribution does not provide homogeneity of variance according to Levene test *(F= 7,446; ,05>,007).*

In Table 2, a significant difference in favor of the science teacher candidates is seen when the scientific attitudes of the teacher candidates are analyzed with respect to their departments *(t=-10,515; p<.05).* When sub dimension that constituted measurement of the scientific attitudes are examined, there is no statistical difference in terms of structure and purpose of science but there is a significant difference in favor of science teachers in the context of other dimensions. The most significant difference in part of scientific attitudes is the enthusiasm towards scientific practice. These results are showed that scientific attitudes of science teacher candidates are higher than primary school teacher, and they feel up to practice science activities.

Scientific attitudes of the teacher candidates according to their learning styles are given in Table 3.

Table 3. *The Scientific Attitudes of the Teacher Candidates with Respect to Their Learning Styles*

	Learning Styles	*N*	$\overline{X}$	*SD*	*t*	*p*
Science Teach.	Accomodator	29	3.60	.237	3.575	.001
Primary School Teach.		30	3.36	.262		
Science Teach.	Diverger	23	3.46	.267	1.965	.053
Primary School Teach.		57	3.33	.276		
Science Teach.	Converger	117	3.64	.241	7.131	.000
Primary School Teach.		118	3.41	.249		
Science Teach.	Assimilator	67	3.55	.233	5.766	.000
Primary School Teach.		118	3.32	.263		

In Table 3, when scientific attitudes of teacher candidates with respect to their learning styles are examined, it is again seen that in accomodator *(d=0.96)*, decomposition *(d=0.93)* and internalization *(d=0.92)* learning styles, averages have a significant difference in favor of science teacher candidates but in diverger style, the difference among groups doesn't seem to have a statistical significance. It is reported that difference among accomodator, converger and assimilator learning styles has a wide influence quantity. However, it is seen that in each learning styles, science teacher candidates use scientific attitudes frequently while in the context of average, this occurs only in converger learning styles for primary school teacher candidates. Generally, we can see the scientific attitudes of science and primary school teacher candidates with respect to their learning styles in the graphic below:

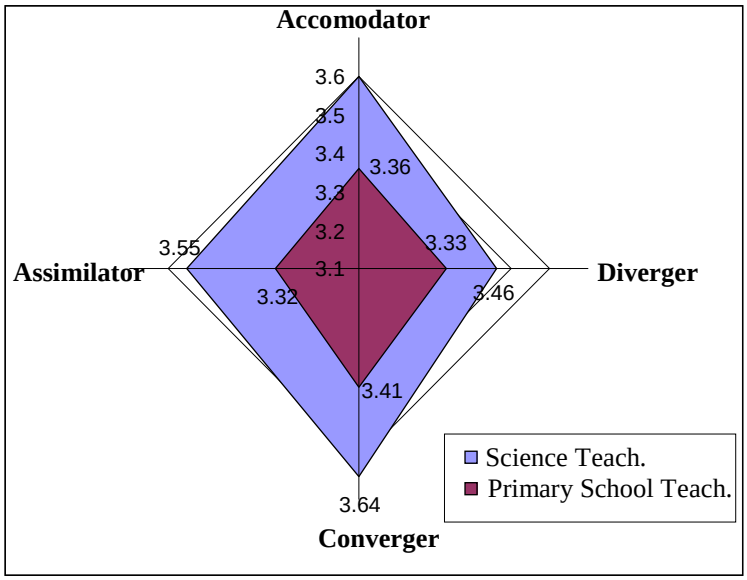

Figure 1. *Scientific Attitude Variances of Teacher Candidates with Respect to Their Learning Styles*

Scientific attitudes of the teacher candidates according to their gender are given in Table 4.

In Table 4, it is seen that average of science teacher candidates with respect to gender features is higher than primary school teacher candidates in both genders. Difference in this average is statistically significant *(d_{female}=0.91; d_{male}=0.88)*. It proves that these independent

variables have a big influence on outcome variables. Also, while science teacher candidates use scientific attitudes frequently, primary school teacher candidates sometimes use it.

Table 4. *The Scientific Attitudes of the Teacher Candidates with Respect to Their Genders*

	Gender	*N*	$\overline{X}$	*SD*	*t*	*p*
Science Teach.	Female	153	3.59	.248	8.656	.000
Primary School Teach.		220	3.36	.257		
Primary School Teach.	Male	83	3.58	.244	5.952	.000
Primary School Teach.		103	3.35	.274		

Scientific attitudes of the teacher candidates according to their grade level are given in Table 5.

Table 5. *The Scientific Attitudes of the Teacher Candidates with Respect to Their Grade Levels*

	Grade	*N*	$\overline{X}$	*SD*	*df*	*t*	*p*
Science Teach.	1st Grade	68	3.59	.242	158	6.844	.000
Primary School Teach.		92	3.32	.249			
Science Teach.	2nd Grade	61	3.52	.248	192	3.669	.000
Primary School Teach.		133	3.38	.251			
*Science Teach.	3rd Grade	59	3.59	.206	96,061	6,220	.000
*Primary Sch.Teach.		53	3.30	.274			
Science Teach.	4th Grade	48	3.68	.274	91	3.992	.000
Primary School Teach.		45	3.44	.284			

* Distribution does not provide homogeneity of variance according to Levene test *(F= 5,474; ,05>,021).*

In Table 5, it is seen that each year, the average point of science teacher candidates is higher than the average point of primary school teacher candidates and this is a significant difference in favor of science teacher candidates *($d_{1.grade}$=1.09; $d_{2.grade}$=0.56; $d_{3.grade}$=1.19; $d_{4.grade}$=0.86).* However, it is also seen that in the fourth grade, average of scientific attitudes of candidates is at its highest. Also, the significant difference on behalf of the 1st, 3rd, 4th year students is large while it is at moderate level for 2nd year students. When it comes to scientific attitudes, it is seen that science teacher candidates use scientific attitude frequently while primary school teacher candidates use it sometimes except 4th year students. Although scientific attitudes were increased from 1st to 4th grade both science and primary school teacher, difference between grades is very low. This result showed that teacher candidates' training programs in university are not effective on their scientific attitudes.

Scientific attitudes of the teacher candidates according to high school they graduated are given in Table 6.

Table 6. *The Scientific Attitudes of the Teacher Candidates with Respect to The High Schools They Graduated*

	Type of High School	*N*	$\overline{X}$	*SD*	*t*	*p*
Science Teach.	Public High School	185	3,57	,248	8,258	,000
Primary School Teach.		220	3,36	,261		
Science Teach.	Super High School	28	3,65	,218	2,836	,007
Primary School Teach.		14	3,44	,240		
Science Teach.	Anatolian High School	23	3,64	,259	4,857	,000
Primary School Teach.		89	3,33	,269		

When scientific attitudes of teacher candidates are surveyed with respect to their secondary education, it is seen that Anatolian High School has the greatest difference among the groups and in each group, science teacher candidates have a significant difference in terms of scientific attitude average in comparison with primary school teacher candidates' averages

($d_{public\ high\ school}$=0.82; $d_{super\ high\ school}$= 0.91; $d_{anatolian\ high\ school}$=1.16). Influence quantity could be recounted as such: Anatolian High School, Super High School, and Public High School. Besides in each one, it is seen that significant difference has a wide effect size. And again, it is seen that science teacher candidates use scientific attitudes frequently while primary school teacher candidates are at the level of "sometimes".

Scientific attitudes of the teacher candidates according to the accommodation units are given in Table 7.

Table 7. *The Scientific Attitudes of the Teacher Candidates with Respect to the Accommodation Units*

	Accommodation Unit	*N*	$\overline{X}$	*SD*	*t*	*p*
Science Teach.	Province	186	3.59	.244	9.226	.000
Primary School Teach.		224	3.36	.267		
Science Teach.	County	50	3.58	.256	4.911	.000
Primary School Teach.		99	3.36	.254		

When scientific attitudes of teacher candidates with respect to accommodation units they studied are analyzed, it is seen that average points in the context of provinces and counties among groups have a significant difference in favor of science teacher candidates *($d_{province}$=0.89; d_{county}=0.86).* This proves that scientific attitude averages of teacher candidates who studied at province or county have a wide influence on explaining variance.

Relationships between upper and lower academic achievement and the scientific attitudes of teacher candidates with Respect to their departments are given in Table 8.

Table 8. *Relationships between Upper and Lower Academic Achievement and the Scientific Attitudes of Teacher Candidates with Respect to Their Departments*

	Department	*Group*	*N*	$\overline{X}$	*SD*	*t*	*p*
General	Primary School Teac.	Upper	173	3,39	,267	2,279	,023
		Lower	150	3,32	,253		
	Science Teacher	Upper	117	3,63	,230	2,710	,007
		Lower	119	3,55	,256		
1. The Structure of Scientific Laws and Theories (laws of science)	Primary School Teac.	Upper	173	3,27	,446	1,720	,086
		Lower	150	3,19	,429		
	Science Teacher	Upper	117	3,39	,373	,786	,432
		Lower	119	3,35	,385		
2. The Structure of Sciences and its Approach to Events (scientific explanation)	Primary School Teac.	Upper	173	3,92	,466	1,784	,075
		Lower	150	3,82	,530		
	Science Teacher	Upper	117	3,79	,410	,255	,799
		Lower	119	3,77	,471		
3. The Presentation of Scientific Behavior (manner of scientific observation)	Primary School Teac.	Upper	173	3,90	,488	2,692	,007
		Lower	150	3,75	,506		
	Science Teacher	Upper	117	4,01	,400	1,752	,081
		Lower	119	3,90	,492		
4. The Structure and Purpose of Sciences (value of scientific activities)	Primary School Teac.	Upper	173	3,00	,405	,019	,985
		Lower	150	3,00	,435		
	Science Teacher	Upper	117	3,01	,360	1,268	,206
		Lower	119	3,07	,331		
5. The Place and Importance of Sciences in Society (usefulness of science to society)	Primary School Teac.	Upper	173	3,48	,548	,754	,451
		Lower	150	3,44	,524		
	Science Teacher	Upper	117	3,84	,500	4,085	,000
		Lower	119	3,57	,537		
6. The Enthusiasm Towards Scientific Practice (student career aspirations)	Primary School Teac.	Upper	173	3,02	,614	,587	,558
		Lower	150	2,98	,589		
	Science Teacher	Upper	117	3,71	,509	1,712	,088
		Lower	119	3,59	,554		

In table 8, the scientific attitudes of teacher candidates according to upper and lower academic achievement is statistically significant in general *($d_{primary}$=,26; $d_{science}$=,32).* Also, it has a small effect size.

These significant difference are caused "The Presentation of Scientific Behavior" in primary school teacher *(d=,30)* and "The Place and Importance of Sciences in Society" in science teacher departments *(d=,52)*. While attitudes of primary school teacher candidates has small effect size, attitudes of science teacher candidates has moderate effect size.

These result showed that the scientific attitudes of teacher candidates according to upper and lower academic achievement can vary, and high achievement teacher candidates has also their high scientific attitudes. However, achievement of primary school teachers increases with increasing display scientific behavior. Science teacher candidates' academic achievement and thoughts about place and importance of science in society are also increased positively.

CONCLUSION and DISCUSSION

Scientific attitudes of teacher candidates have a significant difference in favor of science teacher candidates in terms of their genders, grades, parents' professions, secondary education and learning styles. In general, scientific attitudes of science teacher candidates are higher than primary school teacher candidates'. However, while there are no statistical significant differences in "structure and purpose of science", primary school teacher candidates' average points are higher in "structure and approach of science". Also, higher average points of science teacher candidates in "willingness of doing scientific research" prove that the variance of this rate's outcome variable is explained mostly by independent variable. In general, while science teacher candidates use scientific attitudes frequently, primary school teacher candidates only use it sometimes. In Kumar and Morris's (2005) study, a multiple regression analysis of the relationship between prospective teachers' scientific understanding and Gender, Education Level (High School, College), Courses in Science (Biology, Chemistry, Physics, Earth Science, Astronomy, and Agriculture), Attitude Towards Science, and Attitude Towards Mathematics is reported. The results of this study showed Gender, completion of courses in High School Chemistry and Physics, College Chemistry and Physics, and Attitudes toward Mathematics and Science significantly correlated with scientific understanding. Levin and Jones (1983) noticed a significant relationship between elementary teachers' attitudes toward science, and gender, science instructional ranking and professional status. Also in Türkmen (2002) detected that primary school teacher candidates' attitudes towards science are positive. It is also proved that these attitudes showed big difference with respect to their genders, ages, student selection examination point averages, science classes they had taken during their secondary education, educational and income status of their parents. The result of this study supports the result of the research.

When we analyzed scientific attitudes of teacher candidates with respect to their learning styles, it is an important finding that in diverger style, the difference among groups is not statistically significant. The most important feature of individuals who have diverger style is their thinking capacity and awareness of valuation and meanings. As a matter of fact, in "structure and approach of science", it is seen that scientific attitudes of primary school teacher candidates' average points are significantly high. Also, according to Aşkar and Akkoyunlu (1993), students that have diverger style can revise concrete states from different points and organize relationships significantly. They are patient, objective and careful while learning things but can't get into action. In this context, it can be said that primary school teacher candidates know the structure of science but have a problem with applying it.

The scientific attitudes of teacher candidates according to upper and lower academic achievement can vary. Academic achievement of teacher candidates is affected positively their scientific attitudes. When scale of scientific attitudes is examined, source of significant difference is changed according to their departments. While achievement of primary school teachers increases with increasing display scientific behavior, science teacher candidates' academic achievement and thoughts about place and importance of science in society are also increased. Shrigley (1974) reported a weak positive correlation between cognition levels in science and attitudes toward science among primary school teacher candidates (as cited in Kumar & Morris, 2005). Again, these results are in line with the results of the study.

It is clear that, in their further careers, primary school teacher candidates are supposed to have great contribution to improving scientific attitudes of their students who are going to come across with science terms for the first time. In this context, a formal (laboratory practices, projects, homework related to science performance etc.) and informal (science centers, science camps, science museums, nature walks, national parks, seminars, etc.) activities in education content can be arranged to improve teacher candidates' scientific attitudes. Also, factors that can have an influence on teacher candidates' scientific attitudes can be searched for further studies as well.

REFERENCES

Arseven, A.D. (1993). *Alan araştırma yöntemi*. Ankara: Gül Yayınevi.

Aşkar, P., & Akkoyunlu, B. (1993). Kolb öğrenme stili envanteri. *Eğitim ve Bilim, 87*, 37-47.

Azizoğlu, N., & Çetin, G. (2009). 6 ve 7. Sınıf öğrencilerinin öğrenme stilleri, fen dersine yönelik tutumları ve motivasyonları arasındaki ilişki. *Kastamonu Eğitim Dergisi, 17*(1), 171-182.

Bahadır, H. (2007). *Bilimsel yöntem sürecine dayalı ilköğretim fen eğitiminin bilimsel süreç becerilerine, tutuma, başarıya ve kalıcılığa etkisi* (Yüksek Lisans Tezi). Hacettepe Üniversitesi, Ankara.

Balım, A.G., Sucuoğlu, H., & Aydın, G. (2009). Fen ve teknolojiye yönelik tutum ölçeğinin geliştirilmesi. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi, 25.*

Chin, C. C. (2005). First-year pre-service teachers in taiwan- do they enter the teacher program with satisfactory scientific literacy and attitudes toward science? *International Journal of Science Education, 27*(13), 1549–1570.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research methods in education* (5th ed.). London, New York: Routledge Falmer.

Çıngı, H. (1994). Örnekleme kuramı. Ankara: Hacettepe Üniv. Fen Fakültesi Yay.Çilenti, K. (1988). *Fen eğitimi teknolojisi.* Ankara: Kadıoğlu Matbaası.

Demirbaş, M., & Yağbasan, R. (2006). Fen bilgisi öğretiminde bilimsel tutumların işlevsel önemi ve bilimsel tutum ölçeğinin Türkçeye uyarlanma çalışması. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi,* 19 (2), 271-299.

Demirbaş, M. (2005). *Fen bilgisi öğretiminde sosyal öğrenme teorisinin* öğr*enme ürünlerine etkisinin incelenmesi* (Yayımlanmamış Doktora Tezi). Gazi Üniversitesi Eğitim Bilimleri Enstitüsü, Ankara.

Ergin D. Y., & Özgürol, M. B. (2011). *Bilimsel tutum ve duygusal zeka arasındaki ilişki.* 2nd International Conference on New Trends in Education and Their Implications, Antalya.

Ertem, S. (2007). *Veri toplama ve değerlendirme ünitesinin, ilköğretim öğrencilerinin bilimsel tutum geliştirmelerine katkı getirecek şekilde yeniden düzenlenmesi* (Yayınlanmamış Doktora Tezi). D.E.Ü., Eğitim Bilimleri Enstitüsü, İzmir.

Freedman, M. P. (1997). Relationship among laboratory instruction, attitude toward science, and achievement in science knowledge. *Journal of Research in Science Teaching, 34*(4), 343–357.

Gauld, C. F. (1982). A study of the scientific attitude of science educators who study scientific attitude. *Research in Science Education, 12*, 115-120.

Hamurcu, H. (2002). Fen bilgisi öğretiminde etkili tutumlar. *Eğitim Araştırmaları Dergisi, 8*, 144-152.

Hollsterman, N., Grube, D., & Bögeholz, S. (2010). Hands-on activities and their influence on students' interest. *Res Sci Educ, 40*, 743–757.

Jonnes, B., & Butts, B. (1983). Development of set of scales to measure selected scientific attitudes. *Research in Science Education, 13*, 133-140.

Kumar, D. D., & Morris, J., D. (2005). Predicting scientific understanding of prospective elementary teachers: role of gender, education level, courses in science, and attitudes toward science and mathematics. *Journal of Science Education and Technology, 14*(4), 387-391.

Lane, D. (1993). *Alternative approaches to interpreting effect size Cohen's d.* Retrieved from: http://davidmla ne.com/hyperstat/B153659.html (12.03.2006)

Levin, J., & Jones, C. (1983). *Elementary teachers' attitudes toward science in four areas related to gender differences in students' science performance*. In A Paper Presented at

the Annual Meeting of the American Educational Research Association, Montreal, Canada.

Moore, R. W., & Foy, R. L. H. (1997). The scientific attitude inventory: A revision (SAI II), *Journal of Research in Science Teaching, 34*(4), 327–336.

Muijs, D. (2004). *Doing quantitative research in education.* London: SAGE Publications Ltd.

Singh, P. (1981). Science education and scientific attitudes. *Directions: Journal of Education Studies, 7*, 41-46.

Tait, M. (1981). Fostering the growth of scientific attitudes in young children, *Int. J. Of Early Childhood, 13*(2), 158-1112.

Tabachnick, B.G, & Fidell, L.S. (2001). *Using multivariate statistics* (4th ed.): Boston, MA: Allyn and Bacon.

Tatar, N. (2006). *İlköğretim fen eğitiminde araştırmaya dayalı öğrenme yaklaşımının bilimsel süreç becerilerine, akademik başarıya ve tutuma etkisi* (Yayınlanmamış Doktora Tezi). Gazi Üniversitesi Eğitim Bilimleri Entitüsü, Ankara.

Turgut, M.F. (1992). *Eğitimde ölçme ve değerlendirme metotları*. Ankara: Saydam Matbaası

Türkmen, L. (2002). Sınıf öğretmenliği öğrencilerinin fen bilimleri ve fen bilgisi öğretimine yönelik tutumları. **Hacettepe Üniversitesi Eğitim Fakültesi Dergisi**, *23*, 218-228.

Usta, A., Bodur, H., Yağız, D., & Sünbül, A. M. (2011). İlköğretim fen bilgisi derslerinde öğrenme stillerine dayalı öğretim etkinliklerinin öğrenci erişi ve tutumlara etkisi. *Selçuk Üniversitesi Ahmet Keleşoğlu Eğitim Fakültesi Dergisi, 31*, 1-13.

Yaşar, Ş., & Anagün, Ş.S. (2009). Reliability and validity studies of the science and technology course scientific attitude scale. *Journal of Turkish Science Education, 6*(2), 43-54.