Middle school students' attitudes toward science, scientists, science teachers and classes

Hasan Özgür KAPICI
Yildiz Technical University, Faculty of Education, Istanbul, TURKEY
E-mail: hokapici@yildiz.edu.tr

Hakan AKÇAY
Yildiz Technical University, Faculty of Education, Istanbul, TURKEY
E-mail: hakcay@yildiz.edu.tr

Received 20 Jan., 2016
Revised 17 Jun., 2016

Contents

Abstract

It is indispensable fact that having positive attitude towards science is one of the important factors that promotes students for studying in science. The study is a kind of national study that aims to investigate middle school students', from different regions of Turkey, attitudes toward science, scientists and science classes. The study was done with 2063 students from fourth grade to eighth grade from all regions of Turkey. The Assessing Attitudes and Preferences in Science (AAPS) instrument was used in the current study. The findings showed that students from western regions of

Turkey have more positive attitudes toward science and the other related concepts. Furthermore it was reached that girls have more positive attitudes toward these concepts than boys. It was also found students' attitudes toward science decreases with respect to grade level (or age). Lastly, possible reasons of such results were discussed.

Keywords: age; attitude; gender; science; students

Introduction

Students' attitude towards science is one of the crucial elements that have a major role to motivate students in order to continue their studying in science. On the other hand, several studies (Kind, Jones & Barmby, 2007; Potvin & Hasni, 2014) advocate that number of students, who is eager to study in science related branches, is decreasing. In other words, current students do not hold positive attitudes and beliefs about science which, is bad news for next generations. There are many reasons for this conclusion such as teachers, learning environments (schools), age and even gender. In related literature, there are studies which investigate attitudes toward science with respect to gender (Hill, Corbett & Rose, 2010), age (Osborne, Simon & Tytler, 2009) and teaching method (Beauchamp & Parkinson, 2008). Although there are many studies about it, there is no consensual meaning for 'attitude' (Gardner, 1975; Kind et al., 2007; Osborne, Simon & Collins, 2003) due its complex nature that involves multiple properties from different domains (Zhang & Campbell, 2011). Osborne et al. (2003) define attitude towards science as "feeling, beliefs and values held about an object that might be enterprise of science, school science, and the impact of science on society or scientists themselves" (p. 1053). Furthermore some researchers (e.g. Ajzen, 2001; Crano & Prislin, 2006) state that attitudes are formed based on an individual's personal estimations. Kind et al. (2007) advocate that attitude is judging something along with emotional feelings like having an idea such as good or bad, lovely or beastly. Based on these kinds of definitions and studies in the literature, Reid (2006) states that attitude involves three main components which are cognitive, affective and behavioral and they are related to each other. Cognitive component is introduced as knowledge about an event, object or something like that. Affective component is defined as feeling or emotion about the object (e.g. like or dislike) and lastly, behavioral component is identified as a tendency towards action for the object.

Although attitudes are not much open to change and develop (Reid, 2006), it is attractive topic to investigate for researchers since "they are long-lived, are learned and be taught, and related to behavior" (Young, 1998, p.97). To determine which factors have an impact on someone's attitude towards science, researchers developed some basic criteria. For instance, Kind et al. (2007) asserted that, due to its complex nature, attitudes toward science can be measured based on the agents such as "learning science in school, practical work in science, science outside of school, importance of science, self-concept in science and future participation in science" (p. 877). Osborne et al. (2003, p.1054) collocate some factors, which have an impact on attitudes towards science, as following "(i) anxiety towards science, (ii) self-esteem at science, (iii) motivation towards science, (iv) enjoyment of science, (v) attitudes of peers, friends and parents toward science, (vi) achievement in science and (vii) fear of failure on course". These cognitive and affective components have a role on behavior of an individual as attitude towards science. Furthermore not only these components but also school science curriculum (Hurd, 1991; Khishfe & Boujaoude, 2016) and social environment, communication with each other, students' personalities and characters, needs and interests are other factors (Haste, 2004; Lemke, 2001; Roberts, 2002) that have an impact on attitudes toward science.

Effects of Some Basic Factors on Attitude towards Science

There are several studies which investigate the impacts of gender, age and socio-cultural variations on individuals' attitudes towards science. For example, Baram-Tsabari and Kaadni (2009) designed a study that aims to describe the similarities and differences in the science interests of males and females from Israeli and Arab Middle Eastern Countries. They found that science interests are different with respect to age and gender but there is no meaningful difference between participants from Israeli and Arab Middle Eastern Countries. They concluded that boys are more interested in physics and technology, while girls are eager to learn about biology. The difference in tendency towards science topics between girls and boys are also studied by Haste (2004) and Haste, Muldoon, Hogan and Brosnan (2008). Based on the findings of such studies, it is difficult to advocate that boys have more positive attitudes toward science than girls or vice versa. There are some studies (Miller, Blessing & Schwartz, 2006; Ramsden, 1998; Simpson & Oliver, 1985) which show that girls' attitudes toward science is more negative than boys'. On the contrary, there are also studies which indicate opposite results (Weinburgh, 1995; Tal, Geier & Krajcik, 2000) or show that there is no meaningful difference attitudes toward science based on gender (Barrington & Hendricks, 1988; Çokadar & Külçe, 2008). Although there are contradictive results in related literature, gender is

probably one of the most significant variables about pupils' attitudes toward science since children expose to gender and ethnic issues almost every day from different sources such as TV programs, books, computer games, etc. Moreover scientists are usually assumed as men, spectacled and individuals who wear white-coat (Kaya, Doğan & Öcal, 2008). In order to enable girls more successful at science courses, it is crucial for helping them to develop more positive attitudes toward science (Jarvis & Pell, 2005).

On the other hand, many studies done in Europe and North America concluded that most of students' interests and attitudes toward science arise before the age of 14 (Osborne & Dillon, 2008). Moreover there are studies (Greenfield, 1996; Pell & Jarvis, 2001; Penick & Yager, 1982; Stark & Gray, 1999; Tal et al., 2000) which show that pupils' attitudes toward science decreases from grade 6 to grade 10 respectively. In another study, Sjoberg and Schreiner (2005) found that adolescents in Europe are not eager to continue their careers in science due to low interests and attitudes toward it. Based on these conclusions, it can be said that the interest and positive attitudes of pupils toward science generally decrease age (or grade level). The reasons of such result might be (i) the change of students' interests from school related activities to non-school activities when they get older, (ii) low achievement in school related works, (iii) not offering many opportunities for students to enjoy science and (iv) studying science just for passing the course (Yager, 1996).

Other than gender and age differences, parents and classroom environments such as relationship with other students and teachers, participation into learning process and content, structure and mode of delivery of school science curriculum also have a strong impact on students' success in and attitudes toward science (Boon, 2012; George, 2000; Hurd, 1991; Khishfe & Boujaoude, 2016; Papanastasiou, 2002; Perera, 2014; Simpson & Oliver, 1990; Sun, Bradley & Akers, 2012; Şentürk & Özdemir, 2014). Whereas a few of these studies (e.g. Çokadar & Külçe, 2008) state that parents and social environment do not have an effect on science achievement and attitude towards it, most of other studies (Papanastasiou, 2002; Perera, 2014; Simpson & Oliver, 1990; Sun et al. 2012) state that these variables are crucial factors for students in order to be successful in science related topics and to have positive attitude towards them. The study done by George and Kaplan (1998) suggest that improving the quality of science instruction and activities in schools will have implications for science education in schools and this will, in turn, indirectly affect the science attitudes of students. Furthermore they also provide evidence that parents play a very important role in the development of science attitudes of students.

Purpose of Study and Research Questions

Having high national standards and economic well-being are usually based on highly educated, well trained and adaptable workforce (Osborne et al., 2003). Recently, the decreasing in number of students who choose their careers to continue in science related areas reveals a serious threat to a nation's economic well-being. Due to the fact that there is a linear relationship between science achievement and attitude towards science, it is vital to enable students to have positive attitudes toward science. This will, in turn, affect a nation's future. That's why, studies about students' attitudes toward science and other related concepts are important.

Such kinds of studies are one of the popular topics in national literature of Turkey. There are studies which investigate the effects of teaching methods (Akcay, Yager, Iskander & Turgut, 2010; Akınoğlu & Özkardeş Tandoğan, 2007; Aktamış & Ergin, 2008; Gök, Doğan, Doymuş & Karaçöp, 2009; Özyılmaz Akamca & Hamurcu, 2005; Yenice, 2003), science centers (Bozdoğan & Yalçın, 2006, 2009; Şentürk & Özdemir, 2014; Tereci, Aydın & Orbay, 2008), gender, age, school environment and socio-economic status (Akpınar, Yıldız, Tatar & Ergin, 2009; Çokadar & Külçe, 2008; Saka & Kıyıcı, 2004) on students' achievements in and attitudes toward science. This study is different from others since it involves much more students, who are from different regions of Turkey, and it examines not only students' attitudes toward science but also evaluates their attitudes toward science teachers and classes and usefulness of science. Furthermore the study provides evidences about the impacts of schools' facilities and learning environments from different regions of Turkey on pupils' attitudes toward science and other related concepts. With this respect, in national perspective, the study provides strong evidences for science educators, education politicians and educational psychologists about students' attitudes toward science and other related concepts. In international perspective, studies about attitudes toward science address researchers to conduct similar research designs in their own countries and to compare their findings with international studies' results. Based on these, the study aims to investigate students' attitudes toward science, scientist, science teachers and classes and usefulness of science with respect to their regional differences, genders and grade levels. Three basic research questions given below were developed in order to reach the aim.

1. Do middle school students from different regions of Turkey have different attitudes toward science, scientists, science teachers and classes?

2. Is there a meaningful difference in students' attitudes toward science, scientists, science teachers and classes with respect to their gender?
3. Do middle school students from different grades (from fourth grade to eighth grade) have different attitudes toward science, scientists, science teachers and classes?

Method

Quantitative research method was used in the study. Such kind of research method is used to explain phenomena, attitudes, opinions and behaviors or other defined variables by collecting numerical data that are analyzed using statistically based methods (Aliaga & Gunderson, 2000). Questionnaires are one of the fundamental data collection instruments in this kind of research method. It is easy to reach larger number of participants via them and participants can respond more truthfully while responding to the questionnaires owing to the fact that their responses are anonymous.

Participants

Turkey is geographically divided into seven regions which are Marmara, Aegean, Central Anatolia, Black Sea, Mediterranean, Eastern Anatolia and Southeast Anatolia as shown in Figure 1. The regions in the west side of Turkey have better socio-economic status and schooling rate than others especially Southeast and Eastern Anatolia (Ersungur, Kızıltan & Polat, 2007; Kocabaş, Aladağ & Yavuzalp, 2004). In order to get generalizable results; the data was collected from each different region in Turkey. The sample consisted of 2063 students from fourth grade to eighth grade. Since the studied population is spread across a wide area, cluster sampling method was used for its ease to access the selected sample. One or two cities from each region which are leaders in terms of economy, culture and population was determined as participant source. Then the school list in that city was examined and several schools from both city center and rural areas were chosen. They were asked for whether they are voluntary in order to join the research and the study was done with consentient schools. Table 1 shows the number and percentages of students in terms of gender, regions and grade levels that were involved in this research.

Fig. 1: Map of Turkey with regions

Table 1: Number and Percentages of Students Involved in the Study

Gender	**Number of Students**	***Grade***	**Number of Students**
Male	1073 (52%)	4th Grade	314 (15.2%)
Female	990 (48%)	5th Grade	342 (16.6%)
		6th Grade	443 (21.5%)
Region	**Number of Students**	8th Grade	451 (21.9%)
Marmara	238 (14.1%)	Total	2063
Black Sea	216 (10.5%)		
Eastern Anatolia	181(8.8%)		
Southeast Anatolia	198 (9.6%)		
Mediterranean	90 (4.4%)		

Instrument

The Assessing Attitudes and Preferences in Science (AAPS) instrument was used in the study. It was adapted from the National Assessment of Educational Progress (NAEP, 1978), which was developed by Enger and Yager in 2001. It was designed to evaluate students' attitudes toward science and preferences in science related concepts from grade four to grade 12. The AAPS consists of 30 positive and negative likert-type statements. The first 18 statements are related to students' attitudes toward science and scientists. The other 12 statements are used to gather data about demographic information about the students and the schools. The Cronbach alpha coefficient of the instrument for current study was calculated as .76. The scale aims to measure student attitudes and preferences in the following four sub-scales:

Science Teachers (ST), Science Classes (SC), Usefulness of Science Study (USS) and Perceptions of Being a Scientist (PBS).

Data Analysis

Both descriptive and inferential statistical techniques were used to evaluate the data. The data was analyzed by using the statistical software package (SPSS 17.0). One-Way Anova test was used to compare regions among themselves and to compare grade levels from grade four to grade eight. In addition, post hoc (Tukey) test was used to reveal in which regions there are meaningful differences with respect to each category.

Results

The descriptive analysis of regions of the students for the subscales of Assessing Attitudes and Preferences in Science (AAPS) are reported in Table 2. The mean scores reported in Table 2 indicate that while the subscale of Science Classes (SC) resulted in highest mean score, the perceptions of being a scientist (PBS) resulted in the lowest mean score among the AAPS subscales. Moreover, the Aegean region resulted in the highest mean score and the Middle Anatolia region has the lowest mean score among the regions in terms of the AAPS subscales.

Table 2. Descriptive statistics for students' attitudes toward science teachers, science classes, usefulness of science study and perceptions of being a scientist in terms of regions

Region	N	*Science Teachers*		*Science Classes*		*Usefulness of Science Study*		*Perceptions of Being a Scientist*	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Marmara	238	4.17	0.69	4.28	0.57	3.64	0.54	3.27	0.57
Aegean	150	4.41	0.53	4.46	0.54	3.86	0.51	3.53	0.60
Middle Anatolia	610	4.04	0.83	4.03	0.80	3.57	0.65	3.27	0.63
Black Sea	216	4.10	0.71	4.14	0.70	3.66	0.63	3.22	0.59
East Anatolia	181	4.18	0.81	4.05	0.81	3.67	0.57	3.33	0.56
South Anatolia	198	4.21	0.80	4.26	0.68	3.74	0.66	3.37	0.51
Mediterranean	90	4.37	0.74	4.38	0.59	3.92	0.50	3.31	0.62

Total	1683	4.12	0.78	4.14	0.73	3.64	0.61	3.30	0.59

Comparisons were also done for the subscales of AAPS in terms of regions. The results, which are given on Table 3, indicate that there are meaningful differences among regions for the subscales of SC, ST, USS and PBS.

Table 3. One-way ANOVA test for comparisons among regions

		Sum of Squares	***df***	***Mean Square***	***F***	***Sig.***
Science Teachers	Between Group	46.271	8	5.784	9.76	.000*
	Within Groups	1217.201	2054	.593		
	Total	1263.472	2062			
Science Classes	Between Group	68.467	8	8.558	16.704	.000*
	Within Groups	1052.368	2054	.512		
	Total	1120.835	2062			
Usefulness of Science	Between Group	31.850	8	3.981	10.774	.000*
	Within Groups	758.990	2054	.370		
	Total	790.840	2062			
Perceptions of Being a Scientist	Between Group	11.415	8	1.427	4.087	.000*
	Within Groups	717.196	2054	.349		
	Total	728.611	2062			

In order to reveal in which regions there are meaningful differences with respect to each category, post hoc (Tukey) test was implemented. The result of multiple comparisons among regions for the category of ST was given on Table 4, which indicates that there are significant differences between students from Southeast Anatolia and all the other regions. In addition, it was also found that there are meaningfully different results between Aegean and Central Anatolia and Aegean and Black Sea regions.

Table 4. Comparisons among regions concerning of the subscale of science teachers

Science Teachers		Mean Diff.	Std. Err.	Sig.
Southeast Anatolia				
	Aegean	-.6343	.0853	.000*
	Black Sea	-.3290	.0779	.001*
	Marmara	-.3932	.0762	.000*
	Central Anatolia	-.2707	.0655	.001*
	Eastern Anatolia	-.4014	.0812	.000*
	Mediterranean	-.5950	.0995	.000*
Aegean				
	Black Sea	.3053	.0818	.006*
	Central Anatolia	.3636	.0701	.000*

For attitudes toward SC, meaningful differences were found again between students from Southeast Anatolia and all the other regions. Furthermore other significant differences were reached between students from Central Anatolia and Aegean, Central Anatolia and Marmara, Central Anatolia and Mediterranean regions. Lastly, it was found that there are meaningfully different results between students from Eastern Anatolia and Aegean, and Eastern Anatolia and Marmara regions, which are shown on Table 5.

Table 5. Comparisons among regions concerning of the subscale of science classes

Science Classes		Mean Diff.	Std. Err.	Sig.
Southeast Anatolia				
	Aegean	-.7347	.0793	.000*
	Black Sea	-.4133	.0724	.000*
	Marmara	-.5548	.0709	.000*
	Central Anatolia	-.3101	.0609	.000*
	Eastern Anatolia	-.3271	.0755	.001*
	Mediterranean	-.6507	.0925	.000*
Central Anatolia				
	Aegean	.4246	.0652	.000*
	Marmara	.2446	.0547	.000*
	Mediterranean	-.3406	.0808	.001*

Eastern Anatolia				
	Aegean	-.4076	.0790	.000*
	Marmara	-.2276	.0705	.035*

For the attitudes toward USS, similarly there are meaningful differences between students from Southeast Anatolia and all the other regions. Moreover students from Aegean and Black Sea, Aegean and Marmara, and also Aegean and Middle Anatolia regions are the other regions, which have meaningfully different results that are given on Table 6.

Table 6. Comparisons among regions concerning of the subscale of usefulness of science study

Usefulness of Science Study		**Mean Diff.**	**Std. Err.**	**Sig.**
Southeast Anatolia				
	Aegean	-.5187	.0673	.000*
	Black Sea	-.3133	.0615	.000
	Marmara	-.2948	.0602	.000*
	Central Anatolia	-.2232	.0517	.001*
	Eastern Anatolia	-.3201	.0641	.000*
	Mediterranean	-.4738	.0786	.000*
Aegean				
	Black Sea	.2054	.0646	.040*
	Marmara	.2239	.0633	.012*
	Central Anatolia	.2955	.0554	.000*

Lastly, the results for PBS are shown on Table 7 for which there are meaningful differences between Aegean and the other regions without Eastern Anatolia and Mediterranean.

Table 7. Comparisons among regions concerning of the subscale of perceptions of being a scientist

Perceptions of Being a Scientist		**Mean Diff.**	**Std. Err.**	**Sig.**
Aegean				
	Black Sea	.3105	.0628	.000*
	Marmara	.2590	.0616	.001*
	Central Anatolia	.2625	.0538	.000*
	South-East Anatolia	.2504	.0654	.004*

All the results mentioned above reveal that students from Southeast Anatolia usually have lower attitudes toward science and other related concepts. On the other hand, students from Aegean have more positive attitudes toward those concepts than students from the other regions.

Gender differences were also analyzed in this study. Descriptive analysis for subscales of AAPS in terms of gender (female vs. male) can be seen in Table 8, which indicates that female students have higher mean scores than male students concerning all the AAPS subscales. For both male and female students, whereas the subscale of ST resulted in the highest mean score, the subscale of PBS resulted in the lowest mean scores among the AAPS subscales. Furthermore comparisons between male and female students were also done for each subscale of AAPS and it was reached that there is meaningful difference just for one subscale of AAPS, which is ST. Female students hold more positive attitudes toward science teachers than male students.

Table 8. Descriptive statistics for students' attitudes toward subscales of AAPS in terms of gender

Gender	**N**	**Science Teachers**		**Science Classes**		**Usefulness of Science Study**		**Perceptions of Being a Scientist**	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Male	1073	4.05	0.79	4.13	0.72	3.59	0.59	3.21	0.58
Female	990	4.20	0.75	4.16	0.75	3.70	0.64	3.40	0.60
Total	2063	4.12	0.78	4.14	0.73	3.64	0.62	3.31	0.59

Grade levels were other variable which was investigated in the study. Descriptive analysis for the subscales of AAPS in terms of grade levels (grades 4 to 8) can be seen in Table 9. For all grade levels, the subscale of ST resulted in the highest mean score again, and similarly, the scale of PBS resulted in the lowest mean scores among the AAPS subscales. Table 9 also indicates that fourth graders have highest mean scores and eighth graders have lowest mean scores concerning attitudes toward ST, SC, USS and PBS.

Table 9. Descriptive statistics for students' attitudes toward subscales of AAPS in terms of grade levels

Grade	N	Science Teachers		Science Classes		Usefulness of Science Study		Perceptions of Being a Scientist	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
4th Grade	314	4.45	0.63	4.43	0.58	3.93	0.48	3.35	0.60
5th Grade	342	4.38	0.66	4.34	0.69	3.81	0.49	3.34	0.57
6th Grade	443	4.17	0.71	4.23	0.63	3.72	0.56	3.33	0.61
7th Grade	513	4.03	0.80	4.04	0.75	3.57	0.63	3.31	0.58
8th Grade	451	3.78	0.84	3.80	0.79	3.31	0.67	3.22	0.59

Comparisons were also done for each AAPS subscale in terms of grade levels. The result is shown on Table 10. According to the findings, there are meaningful differences among grade levels for all the AAPS subscales. In order to interpret the findings on Table 10, post hoc test (Tukey) was implemented for each grade level.

Table 10. One-way ANOVA test for comparisons among grade levels

		Sum of Squares	*df*	*Mean Square*	*F*	*Sig.*
Science Teachers	Between Group	117.678	4	29.419	52.841	.000*
	Within Groups	1145.794	2058	.557		
	Total	1263.472	2062			
Science Classes	Between Group	102.057	4	25.514	51.540	.000*
	Within Groups	1018.778	2058	.495		
	Total	1120.835	2062			
Usefulness of Science	Between Group	90.084	4	22.521	66.140	.000*
	Within Groups	700.756	2058	.341		

	Total	790.840	2062			
Perceptions of Being a Scientist	Between Group	5.010	4	1.253	3.563	.007*
	Within Groups	723.601	2058	.352		
	Total	728.611	2062			

According to the findings for students in fourth grade given on Table 11, there are meaningful differences between them and students from sixth, seventh, and eighth grades concerning attitudes toward ST, SC and USS. There is no significant difference between fourth graders and the other grade levels -without eighth grade students- for subscale of PBS.

Table 11. Comparisons between fourth graders and the other graders concerning the subscales of AAPS

Science Teachers		**Mean Diff.**	**Std. Err.**	**Sig.**	***Science Classes***		**Mean Diff.**	**Std. Err.**	**Sig.**
4th grade	6th grade	.2897	.0550	.000*	4th grade	6th grade	.1960	.051	.002*
	7th grade	.4276	.0534	.000*		7th grade	.3954	.050	.000*
	8th grade	.6814	.0548	.000*		8th grade	.6326	.051	.000*
Usefulness of Science		**Mean Diff.**	**Std. Err.**	**Sig.**	**Perceptions of Being a Scientist**		**Mean Diff.**	**Std. Err.**	**Sig.**
4th grade	6th grade	.2085	.0430	.000*	4th grade	8th grade	.1344	.043	.018*
	7th grade	.3540	.0418	.000*					
	8th grade	.6160	.0428	.000*					

Similarly, Table 12 shows that students in fifth grade are significantly different from students in sixth, seventh, and eighth grades concerning attitudes toward ST. Furthermore there are also significant differences between fifth graders and seventh graders, and fifth graders and eighth graders with respect to subscales of SC and USS. For subscale of PBS, it was found that there is no significantly difference between students from fifth grade and students from the other levels. Furthermore, no

significant differences were found between fourth and fifth grades students for the AAPS subscales.

Table 12. Comparisons between fifth graders and the other graders concerning the subscales of AAPS

Science Teachers		**Mean Diff.**	**Std. Err.**	**Sig.**	***Science Classes***		**Mean Diff.**	**Std. Err.**	**Sig.**
5th grade	6th grade	.2142	.0537	.001*	5th grade	7th grade	.3013	.049	.000*
	7th grade	.3521	.0520	.000*		8th grade	.5385	.050	.000*
	8th grade	.6060	.0535	.000*					
	8th grade	.6060	.0535	.000*					
Usefulness of Science		**Mean Diff.**	**Std. Err.**	**Sig.**	**Perceptions of Being a Scientist**		**Mean Diff.**	**Std. Err.**	**Sig.**
5th grade	7th grade	.2411	.0407	.000*	5th grade	4th grade	-.0142	.043	.998
	8th grade	.5031	.0418	.000*		6th grade	-.0005	.042	1.00
						7th grade	.0290	.041	.959
						8th grade	.1202	.042	.038

It can be seen from Table 13, students from sixth grade have significantly different attitudes from seventh and eighth graders with respect to ST, SC and USS. Similarly, there is no significant difference between sixth graders and the other grade levels without eighth grade students for subscale of PBS.

Table 13. Comparisons between sixth graders and the other graders concerning the subscales of AAPS

Science Teachers		**Mean Diff.**	**Std. Err.**	**Sig.**	***Science Classes***		**Mean Diff.**	**Std. Err.**	**Sig.**
6th grade	7th grade	.1379	.0483	.036*	6th grade	7th grade	.1993	.045	.000*
	8th grade	.3917	.0499	.000*		8th	.4366	.047	.000*

						grade			
Usefulness of Science		**Mean Diff.**	**Std. Err.**	**Sig.**	**Perceptions of Being a Scientist**	**Mean Diff.**	**Std. Err.**	**Sig.**	**Mean Diff.**
6th grade	7th grade	.1454	.0378	.001*	6th grade	8th grade	.1208	.039	.020*
	8th grade	.4074	.0390	.000*					

For the seventh and eighth grade students, meaningful differences were found between them and other grade levels regarding attitudes toward ST, SC and USS. As a consequence, all those results from the data indicate that students' attitudes toward ST, SC, USS and PBS decrease with respect to grade levels. In other words, there is an inverse proportion between age and attitudes towards science and other related concepts.

Discussion

This study provides brief information about middle school students' attitudes toward scientists, science teachers and classes, and usefulness of science. It helps us to see the similarities and differences among the regions, gender and grade levels concerning student attitudes toward scientists, science teachers and classes, and usefulness of science.

Student attitudes toward science, scientists, science classes and science teachers affect their interest and motivation when they learn science at school especially in elementary schools. There are studies (e.g. Osborne & Dillon, 2008) which advocate that students' interests and attitudes toward science develop before age 14. It is important to develop positive student attitudes toward science and scientists since if students have positive attitudes, the learning of scientific information and science processes will be enhanced. Attitudes toward science and scientists have an impact on students' views of science, future career awareness and classroom participation (Akcay et al., 2010).

The results of current study show that students who live in the west part of Turkey, mostly have higher positive attitudes toward scientists, science teachers and classes, and usefulness of science. The result supports the idea that general success of students from these regions at university entrance exams and some other national

exams are higher than students from other parts of Turkey. On the other hand, students from Southeast Anatolia have usually less positive attitudes toward these variables. The reason of this conclusion might be due to school related problems such as poor physical conditions, lack of instructional equipment or overcrowded classes and so on. Furthermore, out of school reasons like parents' attitudes toward education or science should have an impact on students' attitudes toward these concepts because parents from Southeast Anatolia generally has lower educational level and more kids than parents from other regions in Turkey. This might be another reason for southeasterner students' lower attitudes toward science and other related concepts. Students from Central Anatolia are the second group who has less positive attitudes toward scientists, science teacher and classes, and usefulness of science. This was an unexpected result since most of schools in this region have better physical conditions and equipment and classroom size than Eastern parts of Turkey. Because of this, the reasons of less positive attitudes toward science, scientists and science teaching and learning should be investigated.

Previous research indicates that there are gender differences concerning achievement, attitude and learning strategies used in science, that often favoring male students over female ones (Kenway & Gough, 1998; Miller et al., 2006; Ramsden, 1998; Simpson & Oliver, 1985). However, in this study the results indicate that female students have higher mean scores than male students regarding attitudes toward scientists, science teachers and classes, and usefulness of science. Yet, the only significant difference found in terms of gender issues was concerned with attitudes toward science teachers. The reason of such a consequence might be students' gender at those ages may have an impact on their communications with people from other gender. It means that male students may have better communication with male teachers or vice versa. To sum up, it is difficult to generalize the effect of gender on attitudes toward science and other related concepts because there are several studies which found that there is no meaningful difference between boys' and girls' attitudes or boys have more positive attitudes toward science than girls (Miller et al., 2006; Ramsden, 1998; Simpson & Oliver, 1985) or the studies which concluded with totally opposite result as the current study (Baram-Tsabari and Kaadni, 2009; Çokadar & Külçe, 2008; Tal et al., 2000).

It was also found that students at early ages have more positive attitudes toward science, scientists and science learning and teaching. Students at fourth and fifth grades have more positive attitudes than the ones from sixth, seventh and eighth grades. The interests and attitudes toward these variables decrease with respect to

grade levels (or age). The result is consistent with the conclusions of some other studies (Greenfield, 1996; Pell & Jarvis, 2001; Stark & Gray, 1999; Tal et al., 2000). Increasing in the complexity of concepts, numbers, formulas and mathematical operations in science topics with respect to grade levels might be one reason for such a conclusion. In order to deal with this situation, the topics or concepts may be taught by associating with daily life events. Different learning methods can be used to increase students' motivations and successes in science teaching which will give rise to positive attitudes toward science ultimately. Certain characteristics of classroom environments that include personal support, use of a variety of teaching strategies, innovative learning activities and student-centered instructional designs are the factors which have an impact on to develop more positive attitudes toward science(Akcay et al., 2010; French & Russell, 2006; Kind et al., 2007; Osborne et al., 2003). It was reached that there is no meaningful difference among grade levels with respect to the subscale of PBS. This result shows that middle school students usually have similar views about perceptions (feelings) of a scientist. This condition can be dealt with emphasizing history and nature of science in science classes. In this way, students will be aware of what science is, why we need it, how scientists work, how scientific knowledge develops and so on.

Conclusion

As a consequence, students from different regions of Turkey have different attitudes towards science, scientists and science courses. In west part of Turkey, students have more positive attitudes towards science. This conclusion can be due to more comfortable and equipped school environments and educated parents; on the other hand, students from Southeast and Central Anatolia regions of Turkey have less positive attitudes than from the other regions. It was expected that students from Southeast region may have less positive attitudes toward science, science learning and scientists since their conditions are worse than the other regions of Turkey. The school environments must be improved in terms of instructional equipment and technology. Students should be supported by counselors since it is difficult for them to share their thoughts with parents. Counselors should act as an advisor and should be a bridge between student and parent. Nonetheless, although students from Middle Anatolia have better school environments than the students from Eastern Anatolia, the possible reason(s), which is students' from Middle Anatolia hold less positive attitudes than their counterparts from Eastern Anatolia, should be investigated. Moreover in terms of

school facilities and opportunities, and ratio of educated parents, the region of Eastern Anatolia in Turkey are not well equipped as well as Middle Anatolia but students from Eastern Anatolia have not so bad attitudes toward science like Middle Anatolia. This result might be owing to students' intrinsic motivations and their teachers. In Turkey, teachers mostly at their early career teach at school in east parts of Turkey and it is assumed that their motivations are higher at the beginning of their professional career. That's why; their students may have more positive attitudes toward science. It is also found that girls are more interested and have more positive attitudes toward science than boys in Turkey. This conclusion is coherent with that girls usually do better than boys at university entrance exams and some other national exams. Lastly, positive interest and attitudes toward science decreases with respect to grade level (or age). From fourth grade to eighth grade, students' attitudes toward science get lower. The reason of this may be increasing in complexity of science related courses. In order to deal with such situation, teachers should try to motivate and attract their students' attention to the courses and scientific events. They can visit science centers and other non-formal educational institutions so as to develop their students' curiosities.

References

Ajzen, I. (2001). Nature and operation of attitudes. Annual Review of Psychology, 52, 27-58.

Akcay, H., Yager, R. E., Iskander, S. M. & Turgut, H. (2010). Change in students' belief about attitudes toward science in grades 6-9. *Asia-Pacific Forum on Science Learning and Teaching, 11*(1), 1-18.

Akınoğlu, O. & Özkardeş Tandoğan, R. (2007). The effects of problem-based active learning in science education on students' academic achievement, attitude and concept learning. *Eurasia Journal of Mathematics, Science and Technology Education, 3*(1), 71-81.

Akpınar, E., Yıldız, E., Tatar, N. & Ergin, Ö. (2009). Students' attitudes toward science and technology: An investigation of gender, grade level and academic achievement. *Procedia-Social and Behavioral Sciences, 1*(1), 2804-2808.

Aktamis, H. & Ergin, Ö. (2008). The effect of scientific process skills education on students' scientific creativity, science attitudes and academic achievements. *Asia-Pacific Forum on Science Learning and Teaching, 9*(1), 1-21.

Aliaga, M. & Gunderson, B. (2000). Interactive statistics. Saddle River, NJ: Prentice Hall.

Baram-Tsabari, A. & Kaadni, A. (2009). Gender dependency and cultural independency of science interest in an open and distant science learning. *The International Review of Research in Open and Distributed Learning, 10*(2). Retrieved fromhttp://www.irrodl.org/index.php/irrodl/article/view/591/1213

Barrington, B. L. & Hendricks, B. (1988). Attitudes toward science and science knowledge of intellectually gifted and average students in third, seventh and eleventh grades. *Journal of Research in Science Teaching, 25*(8), 679-687.

Beauchamp, G. & Parkinson, J. (2008). Pupils' attitudes towards school science as they transfer from an ICT-rich primary school to a secondary school with fewer ICT resources: Does ICT matter? *Education and Information Technologies, 13*(2), 103-118.

Boon, H. J. (2012). Regional Queensland parents' views of science education: some unexpected perceptions. The Australian Educational Researcher, 39(1), 17-43.

Bozdoğan, A. E. & Yalçın, N. (2006). Bilim merkezlerinin ilköğretim öğrencilerinin fene karşı ilgi düzeylerinin değişmesine ve akademik başarılarına etkisi: Enerji parkı. Ege Eğitim Dergisi, 7(2), 95-114.

Bozdoğan, A. E. & Yalçın, N. (2009). Determining the influence of a science exhibition center training program on elementary pupils' interest and achievement in Science. *Eurasia Journal of Mathematics, Science and Technology, 5*(1), 27-34.

Crano, W. D. & Prislin, R. (2006). Attitudes and persuasion. *Annual Review of Psychology, 57*, 345-274.

Çokadar, H. & Külçe, C. (2008). Pupils' attitudes towards science: A case of Turkey. *World Applied Sciences Journal, 3*(1), 102-109.

Enger, S. K. & Yager, R. E. (2001). Assessing student understanding in science (2nd ed.). California: Corwin Press.

Ersungur, Ş. M., Kızıltan, A. & Polat, Ö. (2007). Türkiye'de bölgelerin sosyo-ekonomik gelişmişlik sıralaması: Temel bileşenler analizi. Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi, 21(2), 55-66.

French, D. P. & Russell, C. P. (2006). Improving student attitudes toward biology. In J. J. Mintzes and W. H. Leonard (Eds.), *Handbook of college science teaching* (pp. 15-23). Arlington, VA: NSTA Press.

Gardner, P.L. (1975). Attitudes to science. *Studies in Science Education, 2*, 1-41.

George, R. (2000). Measuring change in students' attitudes toward science over time: An application of latent variable growth modeling. *Journal of Science Education and Technology, 9*(3), 213-225.

George, R. & Kaplan, D. (1998). A structural model of parent and teacher influences on science attitudes of eighth graders: Evidence from NELS: 88. *Science Education, 82*(1), 93-109.

Gök, Ö., Doğan, A., Doymuş, K. & Karaçöp, A. (2009). İşbirlikli öğrenme yönteminin ilköğretim öğrencilerinin akademik başarılarına ve fene olan tutumlarına etkisi. Gazi Eğitim Fakültesi Dergisi, 29(1), 193-209.

Greenfield, T. A. (1996). Gender, ethnicity, science achievement and attitudes. *Journal of Research in Science Teaching, 33*(8), 901-933.

Haste, H. (2004). *Science in my future: A study of values and beliefs in relation to science and technology amongst 11-21 years old*. London: Nestle Social Research Program.

Haste, H., Muldoon, C., Hogan, A. & Brosnan, M. (2008). If girls like ethics in their science and boys like gadgets, can we get science education right? Paper presented at the *British Association for the Advancement of Science Annual Festival*, Liverpool, UK.

Hill, C., Corbett, C. & Rose, A. St. (2010). *Why so few? Women in science, technology, engineering and mathematics.* American Association of University Women. 1111 Sixteenth Street NW, Washington. DC 20036.

Hurd, P. D. (1991). Why we must transform science education. *Educational Leadership, 49*(2), 33-35.

Jarvis, T. & Pell, A. (2005). Factors influencing elementary school children's attitudes toward science before, during and after a visit to the UK National Space Center. *Journal of Research in Science Teaching, 42*(1), 53-83.

Kaya, O. N., Doğan, A. & Öcal, E. (2008). Turkish elementary school students' images of scientists. *Eurasian Journal of Educational Research, 32*, 83-100.

Kenway, J. & Gough, A. (1998). Gender and science education: A review "with attitude." *Studies in Science Education, 31*, 1-30.

Khishfe, R. & Boujaoude, S. (2016). Lebanese students' conceptions of and attitudes towards science and related careers based on their gender and religious affiliations. *International Journal of Science and Mathematics Education, 14*, 145-167.

Kind, P., Jones, K. & Barmby, P. (2007). Developing attitudes towards science measures. *International Journal of Science Education, 29*(7), 871-893.

Kocabaş, İ., Aladağ, S. & Yavuzalp, N. (2004). Eğitim sistemimizdeki okullaşma oranlarının analizi. Paper presented at XIII. Ulusal Eğitim Bilimleri Kurultayı, İnönü University, Malatya, Turkey.

Lemke, J. (2001). Articulating communities: Socio-cultural perspectives on science education. *International Journal of Research in Science Teaching, 38*, 296-316.

Miller, P. H., Blessing, J. S. & Schwartz, S. (2006). Gender differences in high-school students' views about science. *International Journal of Science Education, 28*(4), 363-381.

National Assessment of Educational Progress (NAEP). (1978). *The third assessment of science* (1976-1977). Denver, CO.

Osborne, J. & Dillon, J. (2008). *Science education in Europe: Critical reflections*. Retrieved from http://www.nuffieldfoundation.org/sites/default/files/Sci_Ed_in_Europe_Report_Final.pdf

Osborne, J., Simon, S. & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education, 25*(9), 1049-1079.

Osborne, J., Simon, S. & Tytler, R. (2009). Attitudes toward science: An update. Paper presented *in Annual Meeting of the American Educational Research Association*, San Diego, California.

Özyılmaz Akamca, G. & Hamurcu, H. (2005). Çoklu zekâ kuramı tabanlı öğretimin öğrencilerin fen başarısı, tutumları ve hatırda tutma üzerindeki etkileri. Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 28, 178-187.

Papanastasiou, C. (2002). School, teaching and family influence on student attitudes toward science: Based on TIMSS data for Cyprus. *Studies in Educational Evaluation, 28*, 71-86.

Pell, T. & Jarvis, T. (2001). Developing attitude to science scales for use with children of ages from five to eleven years. *International Journal of Science Education, 23*(8), 847-862.

Penick, J. & Yager, R. E. (1982). Students hold varying perceptions of classes, content, and teachers of school science. *Iowa Curriculum Bulletin, 6*(2), 43-46.

Perera, L. D. H. (2014). Parents' attitudes towards science and their children's science achievement. *International Journal of Science Education, 36*(18), 3021-3041.

Potvin, P. & Hasni, A. (2014). Interest, motivation and attitude towards science and technology at K-12 levels: A systematic review of 12 years of educational research. *Studies in Science Education, 50*(1), 85-129.

Ramsden, J. M. (1998). Mission impossible? : Can anything be done about attitudes to science? *International Journal of Science Education, 20*(2), 125-137.

Reid, N. (2006). Thoughts on attitude measurement. *Research in Science and Technological Education, 24*(1), 3-27.

Roberts, G. (2002). *SET for success: The supply of people with science, technology, engineering and mathematics skills.* London: HM Treasury.

Saka, A. Z. & Kıyıcı, F. B. (2004). Öğrencilerin fene karşı tutumlarını etkileyen faktörlerin belirlenmesi: Sakarya ili örneği. Sakarya Üniversitesi Eğitim Fakültesi Dergisi, 8, 97-111.

Simpson, R. D. & Oliver, J. S. (1985). Attitude toward science and achievement motivation profiles of male and female science students in grade six through ten. *Science Education, 69*, 511-525.

Simpson, R. D. & Oliver, J. S. (1990). A summary of major influences on attitude toward and achievement in science among adolescent students. *Science Education, 74*, 1-18.

Sjoberg, S. & Schreiner, C. (2005). How do learners in different cultures relate to science and technology? *Asia-Pacific Forum on Science Learning, 6*(2), 1-16.

Stark, R. & Gray, D. (1999). Gender preferences in learning science. *International Journal of Science Education, 21*(6), 633-643.

Sun, L., Bradley, K. D. & Akers, K. (2012). A multilevel modeling approach to investigating factors impacting science achievement for secondary school students: PISA Hong Kong sample. *International Journal of Science Education, 34*(14), 2107-2125.

Şentürk, E. & Özdemir, Ö. F. (2014). The effect of science centers on students' attitudes towards science. *International Journal of Science Education, Part B: Communication and Public Engagement, 4*(1), 1-24.

Tal, T., Geier, R. & Krajcik, J. (2000, April). Urban students' beliefs about science in inquiry-based classrooms. Paper presented in *Annual Meeting of the American Educational Research Association*, New Orleans, USA.

Tereci, H., Aydın, M. & Orbay, M. (2008). Bilim ve sanat merkezlerine devam eden öğrencilerin fen tutumlarının incelenmesi: Amasya bilsem örneği. Paper presented in Üstün Zekalı ve Yetenekli Çocuklar Kongresi, Ankara, Turkey.

Weinburgh, M. (1995). Gender differences in student attitudes toward science: A meta-analysis of the literature from 1970 to 1991. *Journal of Research in Science Teaching, 32*(4), 387-398.

Yager, R. E. (1996). *Science/technology/society as reform in science education*. Albany, NY: State University of New York Press.

Yenice, N. (2003). Bilgisayar destekli fen bilgisi öğretiminin öğrencilerin fen ve bilgisayar tutumlarına etkisi. *The Turkish Online Journal of Educational Technology, 2*(4), 79-85.

Young, T. (1998). Student teachers' attitudes towards science (STATS). *Evaluation and Research, 12*(2), 96-111.

Zhang, D. & Campbell, T. (2011). The psychometric evaluation of a three-dimension elementary science attitude survey. *Journal of Science Teacher Education, 22*(7), 595-612.