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THE PRIMARY SCHOOL STUDENTS' ATTITUDE AND ANXIETY TOWARDS SCIENCE

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Abstract. *In this study, the relationships between the attitudes and anxieties of 6th, 7th and 8th grade students about science have been examined. The data have been gathered from a personal data form, anxiety towards science and attitude towards science questionnaires. The effects of such factors, as obtaining assistance with science and technology from outside the classroom, age, gender, class level, school-type variables have been investigated according to their impact on the attitudes and perceptions of the students towards science, and on their anxiety towards science. It has been found that when the students received science-related assistance, it caused significant differences in their attitudes toward science and related anxieties, yet there was no significant difference in terms of gender. Moreover, school-type and class level affect students' attitudes and anxieties towards science. It is believed that increasing the positive science attitudes of the students and decreasing their anxiety will improve success.*

Key words: *anxiety towards science, attitude towards science, primary school, science education.*

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Introduction

A required science and technology course makes the primary school student ready for subsequent education levels by ensuring that the student understands the physical environment with a scientific view, utilizes the nature in an active way, and develops his/her scientific thinking skills. The science and technology curriculum aims to make each individual science and technology literate. The development of positive attitudes toward science can motivate student interest in science education and science-related careers (Carey & Shavelson, 1988; Norwich & Duncan, 1990). Attitudes can influence students' educational achievement in ways that reinforce higher or lower performance (Papanastasiou& Papanastasiou, 2002). Jelinek (1998), Haladyna, Olsen and Shaughnessy (1982), Oliver & Simpson (1998) and Shrigley (1990) have stated that the achievements of students in science have a meaningful relation with their attitudes toward science. Therefore, it is stressed that students need to be provided with a positive attitude toward science, in addition to scientific knowledge, understanding, and skills (Ministry of National Education, 2005). One other way to cultivate the students' scientific literacy is to develop positive attitudes towards science (Cook & Mulvihill, 2008).

Attitude has been one of the most important affective concepts in science education. Attitude recognizes a favourable or unfavourable feeling toward something (Koballa& Warden, 1992), positive or negative feelings about some person, object or issue (Newhouse, 1990; Herron, 1996), feelings about engaging in the behaviour (Chiappetta & Koballa, 2002); therefore, attitude is primarily an effective concept that centres upon the evaluation of an idea. According to the International Encyclopedia of Education "Science attitudes are positive or negative feelings that an individual holds about science subject" (Lakshmi & Rao, 2003). The attitudes are not innate; they are learnt from experiences later on (Tavşancıl, 2005). The attitudes affect the achievement and the achievement

affects the attitudes. There is a proportionate relationship between students' attitudes towards the course and their achievement (Koballa, 1988).

Attitudes towards a course or a subject includes such behaviours as showing the desire to respond back, satisfaction in responding back, acknowledgement of having a value and being in favour of accepting a value (Özçelik, 1992). According to Osborne, Simon and Collins (2003), attitudes towards science, "are the feelings, beliefs and values held about an object that may be the enterprise of science, school science, the impact of science on society or scientists themselves." According to White (1993), an individual's attitude towards a concept like science is shaped by previously held beliefs, which affect his/her sensory reactions and his/her episodes associated with the concept. The emergence of these reactions are important in choosing the science class, making decisions such as acquiring knowledge about scientific subjects or developing science-related hobbies. Science classes in primary education, teachers, the games played, friendships, the books read, journeys and observations affect students' views about science (Atasoy, 2002). Researches on this subject have concluded that a number of factors have been identified as related to students' attitudes towards science. Such factors include: teaching methods, teacher's attitude, influence of parents, gender, age, class levels, religion, cognitive styles of pupils, career interest, societal view of science and scientists, social implications of science and achievement, family's educational background, aspiration and school climate (Halladyna & Shanghnessy, 1982; Simpson & Oliver, 1985; Johnson, 1987; Francis &Greer, 1999; Murphy & Beggs 2001; Pell & Jarvis 2001; Jarvis& Pell, 2002; Papanastasiou & Papanastasiou, 2004; Craker, 2006; George, 2006; Liu, Hu, Jiannong & Adey, 2010).

Another factor that affects the students' success is anxiety. According to Aiken (1976), anxiety is the state of excitedness presenting with bodily, emotional, and mental changes experienced when an individual is confronted with a stimulus (quated by Aydın & Dilmaç, 2004). Schwarzer, Ploeg and Spielberger (1987) define anxiety as an unpleasant emotional reaction that results from the perception or appraisal of a particular situation as threatening. It is also defined as a reaction of the individual against various destructive and disruptive situations towards his/her own being, or the things with which he/she identifies. Anxiety may decrease learning activities by negatively affecting the student, but also may have a facilitative effect on learning by motivating the student to fight with new situations (Yaman, 2010).

The students thoughts about failure of not solving a science problem, and fair of failing in a science exam, create science anxiety. Besides that, there is an expectation that the success of female students will be lower than that of male students. Many factors like these create pressure on the student and cause anxiety (Mallow & Greenburg, 1983). Czerniak and Chiarelott (1984) have shown that high levels of science anxiety decrease success in science classes. Anxiety towards science refers to a worried feeling and a concern related to science. Some researches have been conducted to explore the relationships between anxiety towards science and other educational variables, such as motivation or science achievement (Topçu, 2010). The causes of science anxiety are many, including past bad experiences in science classes, science-anxious teachers in elementary and secondary schools, lack of role models, gender and racial stereotyping, and the stereotyping of scientists in the popular media (Mallow, Kastrup, Bryant, Hislop, Shefner and Udo, 2010). Students with low levels of science anxiety are more motivated in their studies and more motivated to pursue a career in science (Hassan, 2008). Science anxiety almost inevitably leads to science avoidance, and thus affects both the self-image of students and their subsequent capability as adults to make informed political judgments with science and technology components (Mallow et al, 2010).

In studies dealing with science anxiety the subjects such as developing measure, the effect of gender, anxiety among university students, (Greenburg & Mallow, 1982; Mallow & Greenburg, 1983; Mallow, 1994; Udo, Ramsey & Mallow, 2004; Mallow et al, 2010), anxiety towards science teaching, (Marso & Pigge, 1998; Yürük, 2011), anxiety toward chemistry and chemistry laboratory (Bowen, 1999; Azizoğlu & Uzuntiryaki, 2006; Anılan, Görgülü, & Balbağ, 2009; Erökten, 2010) have been studied. There are many studies available regarding the attitudes towards science. But there have not been enough studies to examine the relationship between the anxiety caused by science among primary school students, and the attitude towards science that examines the interaction of success and these two variables.

In this research, the main problem is to determine primary school students' anxieties and attitudes towards science, as well as the relation between anxiety and attitude towards science.

Methodology of Research

General Background of Research

In this study, the main aim is to determine the relationship between the anxiety levels of the secondary stage students of primary school and their attitudes towards science. In addition, it will investigate, how gender, class and school-type (classified according to placement test successes), affect the anxiety and attitudes and perceptions of the students towards science have been examined when they get assistance.

Among the scientific research models, this research is done as a survey model. Survey model is a research approach that aims to describe a situation the way it is (Cohen, Manion & Morrison, 2007; Karasar, 2009).

Sample of Research

The students from the secondary stages of the primary schools of the National Education Directorate in the centre of Amasya in the 2009-2010 educational year make up the population. The samples for the study have been chosen using the clusterization method. In the 6th, 7th and 8th years, placement tests are conducted to arrange the success of the students when they finish primary schools and are about to begin secondary education in Turkey. When choosing the sample, the science results of the placement tests (PT) belonging to the previous year of the primary schools in Amasya have been examined. The schools with the city average, the schools above the average, and the schools below the average have been determined. The working group has been formed by paying attention to choosing equal numbers of students from each class level out of the 6th, 7th and 8th grade students in these schools. Out of the students making up the sample, 313 students (31.5 %) receive education in two schools that are above the PT city average (A1 and A2), 343 of them (34.5 %) in 3 schools that have PT average (B1, B2, B3) and 338 of them (34 %) in three schools that are below PT average (C1, C2, C3). Information about the characteristics of the working group are given in Table 1.

Table 1. Distribution of the research group according to school, class, gender and age.

		N	%			N	%
Primary School	A1	141	14.2	Class level	6	344	34.6
	A2	172	17.3		7	329	33.1
	B1	111	11.2		8	321	32.3
	B2	113	11.4	Age	12	313	31.5
	B3	119	12.0		13	324	32.6
	C1	151	15.2		14	319	32.1
	C2	81	8.1		15	38	3.8
	C3	106	10.7	Gender	female	509	51.2
Total		994	100		male	485	48.8

51.2 % of the students participating in the research (n=509) are girls and 48.8 % of them (n=485) are boys. The rate of the 6th grade students is 34.6 % (n=344), the rate of the 7th grade students is 33.1 % (n=33.1) and the rate of the 8th grade students is 32.3 % (n=321). 313 students that are 12 years old (31.5 %), 324 students that are 13 years old (32.6 %), 319 students that are 14 years old (32.1 %) and 38 students that are 15 years old (3.8 %) make up the sample.

Instrument and Procedures

The form that has been prepared to gather data consists of three sections. In the first section the students are asked their genders, ages, schools, classes and whether they receive assistance for the science and technology classes and if their answers are "Yes", then they are asked where they receive the help. In the second section, there is the science anxiety questionnaire. In the last section there is the questionnaire for the attitude and perception towards science.

The science anxiety questionnaire developed by the researcher consists of 35 items. The questionnaire was initially developed by examining the literature and creating an item pool. For the validity of the contents, two science education experts and two science teachers were consulted and a Likert-style questionnaire form with 54 items has been prepared. Pilot scheme has been conducted with 250 students in a primary school in the centre of Samsun. After the items which decrease reliability were omitted, the questionnaire took its final form. In this form of the questionnaire, the Cronbach alpha coefficient has been determined to be 0.94. The sentences have been graded with the following expressions: "I definitely agree", "I agree", "I am not sure", "I don't agree" and "I definitely don't agree". The coding is on a 1, 2, 3, 4, 5 scale for the sentences supporting the anxiety and 5, 4, 3, 2, 1 for the sentences not supporting the anxiety. Obtaining a high score on the form means that the students are experiencing decreased science anxiety.

The science attitude and perception questionnaire developed by Kaya (2002) is a Likert-style questionnaire for the validation of the contents of which the experts have been negotiated and which has 19 items. The first 12 of the questionnaire items have been prepared to measure the attitudes of the students towards science and the other 7 expressions to measure their perceptions of science and the ways of learning science. In the original scale, cronbach alpha reliability coefficient has been found to be 0.76 and the reliability coefficient has been found to be 0.67 in this study. In the research five point Likert-style has been used. The positive expressions have been coded as 5, 4, 3, 2, 1 and the negative ones as 1, 2, 3, 4, 5.

Data Analysis

In this analysis of the data, SPSS 11.5 program has been used and descriptive statistics, independent samples t-test, univariate covariance analysis and regression analysis have been performed. The total points of the science anxiety (SA) and science attitude and perception (SAP) questionnaire have been found to be $p>0.05$ after Kolmogorov –Smirnov test and it was made sure that the data showed normal distribution. In addition, the applicability of the above-mentioned parametric tests has been checked.

Results of Research

When the participating students were examined in terms of their getting assistance for science and technology courses, 89.4 % of the students (n=889) expressed that they receive assistance for this lesson. When the schools of the students have been classified according to their PT science and technology levels, the asistance cases (according to the classes) of the highly successful A, moderately successful B, and C schools with lower success have been given in Table 2.

Table 2. Distribution of out-of-class assistance of the students according to their school type and class levels.

	A schools		B schools		C schools		Total	
Class level	N	%	N	%	N	%	N	%
6th grade	105	92.1	104	86.0	94	86.2	303	88.1
7th grade	72	93.5	119	94.4	109	86.5	300	91.2
8th grade	115	94.3	84	87.5	87	84.5	286	89.1

88.1% (n=303) of the 6th grade students, 91.2 % (n=300) of the 7th grade students and 89.1 (n=286) of the 8th grade students receive assistance for science and technology class beyond their education in the class. More than 92% of the students in the A-group school receive assistance for science and technology course beyond their education activities in the class. The places/persons from which the students receive help while studying for science and technology course are given in Table 3.

Table 3. Distribution of the places/persons from which the students receive help while studying for science and technology.

	6th grade		7th grade		8th grade		Total	
	N	%	N	%	N	%	N	%
Private teaching institutions	105	30.5	98	29.8	155	48.5	356	36.0
Private tuition	10	2.9	18	5.5	11	3.4	39	3.9
School course	123	35.8	106	32.2	109	34.0	338	34.0
Family	136	39.5	111	33.7	62	19.3	309	31.1
Friends	122	35.5	115	35.0	96	29.9	333	33.5

According to Table 3, 36.0 % of the students reinforce their new knowledge from class through private teaching institutions, 31.1 % of them through their families, 33.5 % of them through their friends and 3.9 % of them through private tuitions.

The effect of the fact that the students received out-of-class assistance for science and technology on their anxieties towards science and their levels of attitudes and perceptions towards science has been examined by means of t-test and the results are given in Table 4.

Table 4. T-test results belonging to SA and SAP averages according to whether the students receive assistance or not.

Test		N	Mean	s	t	df	p
SA	Those receiving assistance	889	120.86	23.42	2.84	992	0.005
	Those not receiving assistance	105	113.85	27.68			
SAP	Those receiving assistance	889	60.78	9.32	3.39	992	0.001
	Those not receiving assistance	105	57.30	13.92			

It has been found that SA and SAP averages of those students who receive assistance while studying science and technology courses are higher than those of the students who do not receive assistance. There is a significant difference between those who receive assistance while studying and those who do not receive assistance in terms of SA averages ($t=2.84$; $p<0.01$). Anxiety levels of those receiving assistance are lower than those of the students who do not receive assistance. There is also a significant difference found between those receiving assistance for the class and those not receiving any assistance in terms of SAP averages ($t=3.39$; $p<0.01$). Those who receive assistance have more positive attitudes and perceptions.

Regression results relating to the prediction of age, whether or not receiving assistance in a science course, class, and anxiety levels about the levels of science attitude and perception are given in Table 5.

Table 5. Multiple regression analysis relating to the age, the state of receiving assistance, class and anxiety levels of students as a prediction about science attitude.

	B	Std. Error	Beta	t	p
Constant	68.645	5.940		11.556	0.000
Age	1.047	0.765	0.095	1.369	0.171
Assistance	-3.386	1.008	-0.105	-3.360	0.001
Class level	-3.152	0.845	-0.259	-3.732	0.000
Anxiety	0.032	0.013	0.076	2.422	0.016
R= 0.230 R^2= 0.053					
$F_{(4, 987)}$= 13.815 p= 0.000					

A low and significant relation gives the variables of age, the status of receiving help, class level and anxiety level, and the science attitudes and perception of students (R=0.230, R^2=0.053, p<0.05). The mentioned variables account for 5.3 % of science attitude and perception. While the variables of receiving assistance and class have a significant effect of p<0.01 on the attitude, the effect of anxiety level is significant as p<0.05 and the age variable does not have a significant effect on the attitude. Regression equity regarding the students' science attitudes and perceptions correspond to the results of regression analysis.

SAP= 68.645 + 1.047 age – 3.386 assistance – 3.152 class + 0.032 anxiety

In order to examine the change of SA and SAP levels among students according to their gender, the status of their receiving assistance in science and technology has been kept under control and univariate covariance analysis has been performed. These results are given in Table 6.

Table 6. ANCOVA results belonging to change of SA and SAP scores according to gender.

Test	Source of Variance	Sum of Squares	df	Mean Square	F	p
SA	Assistance	4595.76	1	4595.76	8.050	0.005
	Gender	19.51	1	19.51	0.034	0.853
	Error	565736.42	991	570.87		
	Total	570369.28	993			
SAP	Assistance	1123.29	1	1123.29	11.436	0.001
	Gender	5.84	1	5.84	0.060	0.807
	Error	97263.20	991	98.224		
	Total	98404.71	993			

According to the analysis, SA average of female students is 120.31 (corrected mean is 120.23), and the average of male students is 119.93 (corrected mean is 119.96). When the variable of receiving assistance in science class was controlled and the effect of gender on SA levels was examined, there was no significant difference between the SA averages of the female and male students (F_{1-993}= 0.034; p>0.01). The SAP average of the female students is 60.5 (corrected mean is 60.49) and the SAP average of the male students is 60.29 (corrected mean is 60.33). When the case of the students receiving assistance in science class was taken as covariant, it was determined that there is not a significant difference between the SAP averages according to gender (F_{1-991}=0.060; p>0.01).

When the schools of the students were grouped according to their PT successes and students' receiving assistance was kept under control, the change of SA and SAP scores according to schools was examined. The ANCOVA results are given in Table 7.

Table 7. ANCOVA results belonging to change of SA and SAP scores according to the schools.

Test	Source of Variance	Sum of squares	df	Mean Square	F	p	Eta Squared	Power
SA	Assistance	5653.03	1	5653.03	10.022	0.002	0.010	0.88
	School	7329.19	2	3664.60	6.497	0.002	0.013	0.91
	Error	558426.73	990	564.06				
	Total	570369.28	993					
SAP	Assistance	1198.90	1	1198.90	12.27	0.000	0.012	0.94
	School	626.79	2	313.40	3.21	0.041	0.006	0.61
	Error	96720.65	990	97.70				
	Total	98475.41	993					

The science anxiety average of the students of A-group schools which have high PT success is 116.42 (corrected mean is 116.12), the average of the students of medium-success schools (B group) is 121.70 (corrected mean is 121.70) and the average of the students of schools with low PT success (C group) is 121.95 (corrected mean is 122.24). It was determined that the students of schools with high PT science success have higher anxieties towards science, but the science anxieties of those students with lower success are lower. When the case of the students receiving assistance in science and technology courses was controlled for, SA scores exhibited significant difference according to school types ($F_{2\text{-}990}$=6.497; p<0.01). According to the Bonferonni test, the source of the difference is the fact that the SA average of the students is lower than the others (B-A and C-A). Effect size, as indicated by the corresponding eta squared value, indicates how much of the variance in the dependent variable is explained by the independent variable. 1.3% of the variance in SA scores can be explained by school type (a small effect size according to Cohen, 1988). Power of test is explained by Pallant (2001) as follows: "Ideally we would like the tests that we use to correctly identify whether in fact there is a difference between our groups. This is called the power of a test." It has been determined that the power of SA test is high (0.91).

The science attitude and perception average of the students from schools with high PT success (A school) is 60.56 (corrected mean is 60.56). The average of the students from schools with medium PT success (B school) is 59.44 (corrected mean is 59.32), while the average of the students from schools with low PT success (C school) is 61.23 (corrected mean is 61.33). It was determined that when receiving assistance in the science and technology course is taken as covariant, there is a significant difference between the SAP averages of the students according to their schools, and this difference is between the students from high and medium levels of success (B-C) ($F_{2\text{-}990}$= 3.21; p<0.05). The effect size and power of the test is medium (0.61).

The changes in students' SA and SAP scores according to their class levels were examined with the case of receiving assistance controlled. ANCOVA results are given in Table 8.

Table 8. ANCOVA results belonging to change of SA and SAP scores according to classes.

Test	Source of Variance	Sum of Squares	df	Mean Square	F	Sig.	Eta Squared	Power
SA	Assistance	4625.85	1	4625.85	8.30	0.004	0.008	0.821
	Class level	13960.58	2	6980.29	12.52	0.000	0.025	0.996
	Error	551795.34	990	557.37				
	Total	570369.28	993					
SAP	Assistance	1180.47	1	1180.47	12.44	0.000	0.012	0.941
	Class level	3410.43	2	1705.22	17.97	0.000	0.035	1.000
	Error	93937.00	990	94.94				
	Total	98404.71	993					

The science anxiety averages of the 6th, 7th and 8th grade students according to their class levels are respectively 123.50, 121.79 and 114.80 (corrected means are 123.62, 121.68 and 114.82 respectively). It was found that there is a significant difference between the SA averages of students according to the class levels ($F_{2\text{-}990}$=12.524; p<0.01). Students have lower levels of anxiety in 6th grade, but they have higher levels of anxiety in 8th grade.

Similarly, it was determined that SAP averages according to classes are respectively 62.55, 60.45 and 58.06 (corrected means are 62.59, 60.33 and 58.06 respectively), and there is a significant difference among the averages ($F_{2\text{-}990}$=17.97; p<0.01) of the 6th-7th, 6th-8th and 7th-8th grades. 2.5 % of the variance in SA scores and 3.5 % the variance in SAP scores can be explained by class level. The distinctiveness of SA and SAP tests according to class levels is high.

Discussion

The distribution of the research group across schools was: 292 students from schools with high PT success (105 students from the 6th grade, 72 from the 7th grade and 115 from the 8th grade), 307 students from schools with medium PT success (104 students from the 6th grade, 119 from the 7th grade, 84 from the 8th grade), and 280 students from schools with low PT success (94 students from the 6th grade, 109 from the 7th grade and 87 from the 8th grade). 89.4% of the students receive assistance (through private teaching institutions, school courses, family, friends or private tuitions) while studying science and technology courses in their schools. 30.5% of the 6th grade students and 48.5% of the 8th grade students attend private teaching institutions (Table 3). In the 6th grade the family, in the 7th grade the friends, and in the 8th grade the private teaching institutions provide the most assistance for the science and technology course.

The fact that the students receive out-of-school assistance for science courses caused significant differences in their anxiety and attitudes towards science. It was found that the anxiety levels of the students receiving assistance from outside decrease, but their levels of positive attitude and perception increase. Among the objectives of science education is to establish a substructure that enables students to develop their knowledge, experience and interests in education and choice of profession in the future (MNE, 2005). The fact that the science-related anxiety of the students receiving out-of-school assistance decreased suggests that they will achieve their science goals after primary school and/or be succesful in future science classes. Yıldırım (2000) established that the support of teacher and family affects student success. Similarly, this study indicates that family, friends, private teaching institutions and similar courses affect the attitudes and anxieties of students towards science.

The results of regression analysis show that receiving assistance in science courses, class level and science anxiety significantly affect the attitude and perception of a student towards science (Table 5). Age, class, anxiety and receiving help account for 5.3% of attitude scores. In the studies of Akman, İzgi, Bağçe and Akıllı (2007), in which it was determined that there is a relationship at a low level of statistical significance between science attitudes and test anxiety, 4.0% of attitude scores can be explained by anxiety.

No significant difference was found between the science anxiety levels of male and female students. Similarly, Akman et al. (2007) also did not find a significant difference between anxiety levels according to gender. Udo et al. (2004), however, states that gender is the strongest predictor of science anxiety. Mallow (1994), Brownlow, Jacobi and Rogers (2000) and Udo et al. (2004) state that female students have higher levels of science anxiety, while Hassan (2008) states that female students have less science anxiety. Brownlow et al. (2000) shows that females who were anxious about science interpreted their ability to do science more negatively than males, and took fewer science courses. Mallow (1994) states that negative attitudes toward science are linked to science anxiety, which in turn decreases the likelihood of further pursuit of and achievement in science. Kahle and Lakes (1983) argue that their data show conclusively that a lack of science experience leads to a lack of science understanding and contributes to negative attitudes toward science. In the literature, it is also suggested that because female students don't believe they are competent in science, find science too masculine and think the fields of art, literature, language are more suitable for them, they increase their science anxiety (Jovanic & King,

1998; Archer, 1992). Yet in this research, it was found that anxiety levels toward a science of female and male students are similar, but science anxiety among females is less.

It was found that there is not a significant difference between the science attitudes and perceptions of female and male students and that the average of the females is high. Henry (1996), Morell and Lederman (1998), George (2000), Altınok (2005), Akman et al (2007) argue that attitudes towards science do not change according to gender, but Gezer, Köse and Bilen (2006) and Jarvis and Pell (2002) state that female students have more positive attitudes towards science than male students. Francis and Greer (1999) also found that girls are just as likely as boys to perceive the importance of science but are less likely to translate that perception into positive attitudes towards science. In many studies, however, compared to female students, male students have more positive attitudes (Simpson & Oliver, 1985; Francis & Greer; 1999; Weinburg, 1995; Craker, 2006). The expectation is that the anxiety of the female students should be low and their attitudes should be highly positive and the findings of the research support this.

A significant difference between the science anxiety levels of the students and their science attitude and perception levels has been found based on their schools (Table 7). The students from schools with high PT success have high science anxiety and medium-level science attitudes. The students from schools with medium-level PT success have medium-level science anxiety and low science attitudes; the students from schools with low PT success have low science anxiety and high science attitudes. Spielberger (1980) studied the correlation between the students' level of anxiety and their success at school, and the results indicated that there was a significant negative correlation between the two variables, and that the individuals who had a higher level of anxiety were less efficient in cognitive activities, such as school performance and learning (quoted in Akman et al., 2007).

Pajares, Britner and Valiante (2000) stated that students with low success have higher science anxiety and think that they will fail in science-related activities. As the students with less science anxiety are less stressed and anxious while studying, they are more successful and they have more positive attitudes (Atwater, Gardner, and Wiggins, 1995). In addition, the fact that families expect high performance that exceeds the capacity of their children forces them to be successful and probably increases their anxieties (Öztürk, 1977; quoted in Akman et al., 2007). The anxiety level of students from successful schools can be linked to the fact that those students have higher success objectives and their families have numerous expectations. There is a smaller correlation between science attitude and science success and positive attitudes affect the success (Simpson & Oliver, 1985; Freedman, 1997). In this study, the students from schools with lower PT success had more positive attitudes.

The more the class levels of the students increase, the more their science anxieties increase and their attitudes decrease. Significant differences were determined among the classes in terms of anxiety and attitude (Table 8). Although at the upper grades the ages and science experiences of the students increase, the seriousness and importance of the examination they will take in the 8th grade may cause their anxiety to increase. Chiarelott and Czerniak (1985, 1987) studied school children in fourth through ninth grade (ages 9–14) and demonstrated that science anxiety begins as early as age nine. Hassan (2008) determined in his study with 10th, 11th and 12th grade students that the anxiety levels of the 10th grade students were less than those of the 11th and 12th grade students, and that there is a significant difference between them. Oliver & Simpson (1988) in their longitudinal studies among 6th – 10th grades stated that attitudes related to science anxiety as well as class level are informative of science success in the future (quoted in Cassady, 2010). In the literatures, it has been stated that science attitudes of young students are more positive than those of the older students and even that these attitudes begin to decrease in primary school (Francis & Greer, 1999; Morrell & Lederman, 1998; Simpson & Oliver 1985; Pell & Jarvis, 2001; Murphy & Beggs, 2001). In addition, it is shown in Table 3 of this study that the 6th grade students receive more school courses than the 7th and 8th grade students. They also receive assistance from their families and friends. The 8th grade students, however, generally receive assistance from private teaching institutions for science class. It may be that receiving assistance from different places (as in 6th grade students) improves their science attitudes and perceptions and with age, the science attitude decreases.

Conclusion

This research is important because it examines the relationships between secondary school students' attitudes toward and perceptions of science and the factors that affect those attitudes. Students who receive out-of-class science and technology assistance have less anxiety and better attitudes towards science. It has also been established that gender has no significant effect on science anxiety and science attitudes. However, the regression analysis conducted indicates that the students' science attitudes and perceptions are influenced by age, class, out-of-class assistance and anxiety levels. Science attitude and anxiety of the students show significant differences according to their schools. It has been determined that the students from the schools that are defined to be successful in PT have the highest science anxiety and medium-level science attitudes. The students from the schools with lower PT success have the least science anxiety averages and the most positive attitudes towards science. The science anxiety and attitudes of the students according to class levels also show significant differences; the more the class level increases, the more science anxieties and negative attitudes toward science increase.

Childrens' interest in science and science-related fields from early ages is a guiding light in their future lives. Positive attitudes toward science are instrumental in students' choice of profession, making careers in science, making decisions in sociological topics, and developing thinking strategies by evaluating logical and scientific evidences. Attitudes affect success, which in turn affects attitudes. According to PISA (Programme for International Student Assessment) 2009 results, Turkey's science average (454) is found to be below the OECD average (501). The fact that Turkey was at the bottom of the science success ranking among the 65 countries participating in this evaluation might very well result from the attitudes and inattention of students towards science. Positive attitudes foster success. If positive attitudes towards science can be developed, then individuals who question and understand the nature of science better, and who are productive, can be raised. After all, these attitudes are not just a behavioural tendency or feeling but also the integration of cognition, feeling, and behaviour. Positive attitudes towards science decrease anxiety. In science and technology classes integrated with experiments, observations and projects, students have more positive attitudes and thus their anxiety towards science decreases. Teachers need to enrich their science classes with practice and activities, to make students active in the classroom, to use different methods and materials in education by accommodating innovations and changes in science. Thus, students who love science, who don't ignore the activities, and who don't have anxiety towards science-related success or anxiety towards science topics will be ready for secondary education.

References

Akman, B., İzgi, Ü., Bağçe, H. & Akıllı, H. İ. (2007). The effect of elementary students' attitude towards science on their levels of test anxiety. *Education and Science*, *32* (146), 3-11.

Altınok, H. (2005). Cinsiyet ve başarı durumlarına göre ilköğretim 5. sınıf öğrencilerinin fen bilgisi dersine yönelik tutumları. *Eğitim Araştırmaları Dergisi*, Sayı, *18*, 81.

Anılan, B., Görgülü, A., Balbağ, M. Z. (2009). Öğretmen adaylarının kimya laboratuvarı endişeleri. *e – Journal of New World Sciences Academy*, *4* (3), 954-974.

Archer, J. (1992). Gender stereotyping of school subjects. *The Psychologist, 5*, 66-69.

Atwater**,** M. M., Wiggins, J. & Gardner, C. M. (1995). A study of urban middle school students with high and low attitudes toward science, *Journal of Research in Science Teaching*, *32* (6), 665- 667

Aydın, E. & Dilmaç, B. (2004). *Matematik kaygısı. Eğitime iliskin çesitlemeler 1*. (Edt: M. Gürsel). Konya: Eğitim Kitabevi Yayınları, 231-240.

Atasoy, B. (2002). *Fen öğrenimi ve öğretimi*. Gündüz Eğitim ve Yayıncılık, Ankara.

Azizoğlu, N., & Uzuntiryaki, E. (2006). Kimya laboratuar endişe ölçeği. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 30*, 55-62.

Bowen, C. W. (1999). Development and score validation of a chemistry laboratory anxiety instrument (CLAI) for college chemistry students. *Educational and Psychological Measurement, 59* (1), 171-187.

Brownlow, S., Jacobi, T., & Rogers, M. (2000). Science anxiety as a function of gender and experience. *Sex Roles, 42* (1-2), 119-131

Carey, N., & Shavelson, R. (1988). *Outcomes, achievement, participation, and attitudes*. In R. J. Shavelson, L. M. McDonnell, & J. Oakes (Eds.), Indicators for monitoring mathematics and science education (pp. 147-191). Santa

Monica, CA: Rand Corporation.
Cassady, J. C. (2010). *Anxiety in schools: The causes, consequences and solutions for academic Anxieties*. Peter Lang Publishing. Inc. New York. p: 83-84.
Chiarelott, L., & Czerniak, C. (1985). Science anxiety among elementary school students: An equity issue. *Journal of Education Equity and Leadership, 5*, 291-308.
Chiarelott, L., & Czerniak, C. (1987). Science anxiety: Implications for science curriculum and teaching. *The clearing house,* 60, 202-205.
Chiapetta, E. L., & Koballa, T. R. (2002). *Science instruction in the middle and secondary scho*ols. Fifth Edition Pearson Education Inc., New Jersey, p 69-70
Cook, M., & Mulvihill, T. M. (2008). Examining US college students' attitudes towards science: Learning from non-science majors. *Educational Research and Review*, *3* (1), 38-47.
Cohen, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd edition). Hillsdale, NJ: Erlbaum.
Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education*. Publisher: Routledge; 6th edition, London
Craker, D. E. (2006). Attitudes towards science of students enrolled in introductory level science courses at UW- La Crosse. *UW-L Journal of Undergraduate Research IX*.
Czemiak, C., & Chiarelott, L. (1984). *Science anxiety: an investigation of science achievement, sex and grade level factors.* Paper presented at the 68th Annual Meeting of the American Educational Research Association, New Orleans, LA, April 23-27.
Erökten, S. (2010). Fen bilgisi öğrencilerinde kimya laboratuar uygulamalarının öğrenci endişeleri üzerine etkisinin değerlendirilmesi. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *38*, 107-114.
Francis, L. J., & Greer, J. E. (1999). Attitude toward science among secondary school pupils in Northern ıreland: relationship with sex, age and religion. *Research in Science Technological Education*, *17*, 1, 67-74.
George, R. (2000). Measuring change ın students' attitudes toward science over time: an application of latent variable growth modelling. *Journal of Science Education and Technology*, *9*, 213-225.
George, R. (2006). A Cross- domain analysis of change in students' attitudes toward science and attitudes about the utility of science. *International Journal of Science Education*, *28*, 6, 571-589.
Gezer, K., Köse, S., & Bilen, K. (2006). *6. Sınıf öğrencilerinin fen bilgisine yönelik tutumları (Buldan Örneği)*, Buldan Sempozyumu bildiriler kitabı.
Greenburg, S. L., & Mallow, J. V. (1982). Treating science anxiety in a university counselling centre. *The Personel and Guidance Journal*, 48-50.
Haladyna, T., Olsen, R., & Shaughnessy, J. (1982). Relations of student, teacher, and learning environment variables to attitudes to science. *Science Education*, *66*, 671–687.
Halladyna, T., & Shanghnessy, J. (1982). Attitudes towards science: A qualitative synthesis. *Journal of Research in Science Teaching*, *66* (4), 547-563.
Hassan, G. (2008). Attitudes toward science among Australian tertiary and secondary school students. *Research in Science & Technological Education*, *26* (2), 129-147.
Henry, G. H. (1996). *A study ınvestigating student and teacher attitudes toward science and science education.* Unpublished Doctorate Thesis, The University of Dayton, Dayton.
Herron, J. D. (1996). The chemistry classroom formulas for successful teaching. *American Chemical Society,* Washington, p 229.
Jarvıs, T., & Pell, A. (2002). Changes in primary boys' and girls' attitudes to school and science during a two-year science in-service programme. *The Curriculum Journal*, *13*, 1, 43-69.
Jelinek, D. J. (1998). Student perceptions of the nature of science and attitudes towards science education in an experiential science program. *Paper Presented at the Annual Meeting of the National Association for Research in Science Teaching*, San Diego, CA (ED418875)
Johnson, S. (1987). Gender differences in science: parallels in interest, experience and performance. *International Journal of Science Education*, *9*, 467-481.
Jovanovic, J., & King, S. S. (1998). Boys and girls in the performance-based science classroom: who's doing the performing? *American Educational Research Journal*, *35*, 477-496.
Kahle, J. B., & Lakes, M. K. (1983). The myth of equality in science classrooms. *Journal of Research in Science Teaching, 20*, 131-140.
Karasar, N. (2009). *Bilimsel araştırma yöntemi*. 19. Baskı. Ankara: Nobel Yayın Dağıtım.
Kaya, O. N. (2002). *İlköğretim 7. Sınıf Öğrencilerinin Atom ve Atomik Yapı Konusundaki Başarılarına, Öğrendikleri Bilgilerin Kalıcılığına, Tutum ve Algılamalarına Çoklu Zeka Kuramının Etkisi*. Yayınlanmamış Yüksek Lisans Tezi. Gazi Üniversitesi, Eğitim Bilimleri Enstitüsü, Fen Bilgisi Öğretmenliği Bilim Dalı.
Koballa, T. R. (1988). Attitude and related concepts in science education. *Science Education*, *72*, 115-126.
Koballa, T. R., & Warden, M. A. (1992). *Changing and measuring attitudes in the science classroom*. In F. Lawrenz, K. Cochran & J. Krajcik (Eds.) Research matters to the science teacher (pp 75-83) Manhattan, KS: National Association for Research in Science Teaching.
Lakshmi, G. B., & Rao, D. B. (2003). *Attitude towards science*. Discovery Publishing House, New Delhi.

Liu, M., Hu, W., Jiannong, S., & Adey, P. (2010). Gender stereotyping and affective attitudes towards science in Chinese secondary school students. *International Journal of Science Education*, *32* (3), 379-395.

Mallow, J. V., & Greenburg, S. L. (1983). *Science anxiety and science learning*. The Physics Teacher, pp: 95-99.

Mallow, J. V. (1994). Gender-related science anxiety: A first binational study. *Journal of Science Education and Technology, 3* (4), 227-238.

Mallow, J. V., Kastrup, H., Bryant, F. B., Hislop, N., Shefner, R., & Udo, M. (2010). Science anxiety, science attitudes, and gender: interviews from a binational study. *Journal of Science Educational Technology, 19*, 356-369.

Marso, R. N., & Pigge, F. L. (1998). *A longitudinal study of relationships between attitudes toward teaching, anxiety about teaching, self-perceived effectiveness, and attrition from teaching.* Paper presented at the Annual Meeting of the Association of Teacher Educators, Dallas, TX.

Ministry of National Education (2005). *The curriculum of 6th and 8th grade science and technology course*. Ankara, Turkey.

Morrell, P. D., & Ledeerman, N. G. (1998). Students' attitudes toward school and classroom science: Are they independent phenomena? *School Science & Mathematics*, *98* (2), 76-84.

Murphy, C., & Beggs, J. (2001). *Pupils' attitudes, perceptions and understanding of primary science: comparisons between northern ırish and English schools*. Paper presented at the Annual Meeting of the British Educational Research Association, Leeds, 14–16 September.

Newhouse, N. (1990). Implications of attitudes and behaviour research for environmental conservation. *The Journal of Environmental Education*, *22* (1), 26-32.

Norwich, B., & Duncan, J. (1990). Attitudes, subjective norm, perceived preventive factors, intentions and learning science: Testing a modified theory of reasoned action. *British Journal of Educational Psychology, 60*, 312-321.

Oliver, J. S., & Sımpson, R. D. (1988). Influences of attitude toward science, achievement motivation, and science self concept on achievement ın science: a longitudinal study. *Science Education*, *72*, 143-155.

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.

Özçelik, D. A. (1992). *Eğitim programları ve öğretim.* ÖSYM Yayınları, Ankara.

Pajares, F., Britner, S. L., & Valiante, G. (2000). Writing and science achievement goals of middle school students. *Contemporary Educational Psychology*, *25*, 406-422.

Pallant, J. (2001). *SPSS survival manual*. Open University Press, Buckingham and Philadelphia, USA.

Papanastasiou, C., & Papanastasiou, E. C. (2002). The process of science achievement. *Science Education International*, *13* (2), 12-24.

Papanastasiou, C., & Papanastasiou, E. C. (2004). Major influences on attitudes toward science. *Educational Research and Evaluation*, *10* (3), 239-257.

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

Schwarzer, R., Ploeg, H. M. V., & Spielberger, C. D. (1987) *Test anxiety: An overview of theory and research*. In Spielberger, C.d. (Eds.) Advances in Test Anxiety Research Lissee: Hiisdale, N.J. Sweets and Zeitlenger/ Erlbaum.

Shrigley, R. L. (1990). Attitude and behavior are correlates. *Journal of Research in Science Teaching*, *27*, 97-113.

Simpson, R. D., & Oliver, J. S. (1985). Attitude toward science and achievement motivation profiles of male and female science students in grades six through ten. *Science Education, 69* (4), 511-526.

Spielberger, C. (1980). *Preliminary professional manual for test anxiety ınventory*. Palo Alto, C. A: Consulting Psychologist Pres.

Tavşancıl, E. (2005). *Tutumların ölçülmesi ve SPSS ile veri analizi.* Ankara: Nobel Yayın Dağıtım.

Topcu, M. S. (2010). Development of Attitudes towards Socioscientific Issues Scale for undergraduate students. *Evaluation & Research in Education*, *23* (1), 51-67

Udo, M. K., Ramsey, G. P., & Mallow, J. V. (2004). Science Anxiety and Gender in Students Taking General Education Science Courses. *Journal of Science Education and Technology*, *13* (4), 435-446.

White, R. T. (1993). *Learning science*. Blackwell Publishers, Oxford, UK.

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

Yaman, H. (2010). Writing anxiety of Turkish students: scale development and the working procedures in terms of various variables. *International Online Journal of Educational Sciences*, *2* (1), 267-289.

Yıldırım, İ. (2000). Akademik başarının yordayıcısı olarak yalnızlık, sınav kaygısı ve sosyal destek. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 18,* 167-176.

Yürük, N. (2011). The predıctors of preservıce elementary teachers' anxiety about teachıng scıence. *Journal of Baltic Science Education*, *10* (1), 17-26.

Appendix

A. Items to measure anxiety toward science

1. I feel uneasy and bad while learning Science
2. I get into panic when I cannot remember the answer of the question in a Science and Technology exam.
3. While studying for the Science and Technology exam, I cannot study properly because of thinking what will be asked in the exam.
4. I get into a panic thinking that I may not be able to do Science and Technology homework that the teacher assigns.
5. When I open the book to study a difficult science topic, I feel quite troubled.
6. I start to feel unrest a week before the Science and Technology class.
7. When I am given the school report, I feel afraid to look at my Science and Technology grade.
8. I don't want to study science topics if it were not obligatory.
9. I get confused in Science and Technology class.
10. I get into a panic when I enter the science laboratory.
11. I get very excited when I wait for the result of a Science and Technology exam which I feel I did well.
12. When the teacher wants me to solve a question before the blackboard, I cannot do it out of excitement though I know the answer.
13. I cannot solve Science questions when somebody watches me.
14. It makes me anxious to open a Science textbook and have a look at the page where there is a Physics topic.
15. When the next class is Science and Technology, I get bothered.
16. I cannot dare to ask the points I have not fully understood in Science and Technology class.
17. In Science and Technology classes I forget all I know due to excitement.
18. I get into panic when the teacher assigns a homework that contains numerous science questions.
19. Studying for SBS prevents me from focusing on Science and Technology class.
20. I don't want to go to school on days when there is the Science and Technology class.
21. I hold off from even explaining the problems that I can solve.
22. When the teacher makes us take a science examination without notice, I get anxious that I will have a low grade.
23. The formulas seem antipathetic to me in Science and Technology class.
24. Seeing the Science and Technology book disturbs me.
25. When I open any Science book, it pleases me to see questions about Chemistry topics.
26. I get anxious from the thought that I will not be able to answer science questions in PT.
27. When I go over to the blackboard for a question the answer of which I don't know completely I get scared.
28. I can easily ask a point I haven't understood to the Science and Technology teacher after the class.
29. I wish there were a Science and Technology Club at school and I would join this club.
30. If my friend notices that I don't understand the solution of a problem, I get angry.
31. While studying for the Science and Technology exam, I cannot study properly because of thinking what grade I will have.
32. I have difficulty in listening to the teacher.
33. Conducting experiments in Science and Technology class makes me anxious.
34. If my friend wants me to solve a science question in an education magazine, I feel afraid not to be able to solve the simplest questions and to be ashamed.
35. While awaiting the results of a Science and Technology class which I feel I didn't do well, I am quite pessimist.

B. Items to measure attitudes and perception towards science

1. I find science classes interesting and pleasurable.
2. I want to learn more about science classes.
3. Science classes are boring.
4. I like reading science books.
5. Science classes are too complicated and difficult to understand.
6. I like solving problems about science topics.
7. I wish the hours for science classes were more.
8. I think the science classes are unnecessary.
9. I like science classes.
10. I allocate much of my study time to science classes.
11. Among the classes we have, the science classes are the most antipathetic ones.
12. I believe that the hours of science classes are fruitless and idle.
13. Science classes lead me into thinking and questioning.
14. Science classes have a very important place in daily life.
15. In physical sciences, reasoning is very important.
16. There is no need for science classes to explain natural phenomena.
17. Science classes develop the desire and curiosity of exploration of the students.
18. You don't need to think too much to understand science classes.
19. Science topics help us understand natural phenomena.

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