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Science Teaching Attitudes and Scientific Attitudes of Pre-service Teachers of Gifted Students

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Abstract
The purpose of this study is to determine science teaching attitudes and scientific attitudes of pre-service teachers of gifted students due to gender and grade level and also correlation among these variables. It is a survey study that the group is 82 students attending Gifted Education undergraduate level. Data is gathered by Scientific Attitude Inventory, SAI II and Science Teaching Attitude Scale. Then data is analyzed by independent samples t test, ANOVA, correlation and regression statistical methods. As conclusion, there is a significant difference due to grade level and there is a high correlation between scientific attitudes and science teaching attitudes. In this context it is recommended that learning environment which positively effect scientific attitudes and science teaching attitudes should be organized.
Keywords: gifted, pre-service teacher, scientific attitude, science teaching attitude

1. Introduction

Necessity of identification and differentiated education for gifted students has been articulated among researches for a few decades. So it is very important to train qualified teachers that are able to discover the potentials of those gifted learners and support their progresses considering their social-emotional, learning and individual needs. Gifted and talented students have an inborn interest in science because it triggers their native curiosity and imagination (Smutny & Von Fremd, 2004). On the other hand, Van Tassel-Baska & Stambaugh (2006) state that none of the other domains can positively challenge their interests and minds as much as science does. These students need to develop their skills under the circumstance of science and scientific processes. Thus, at this point, teachers are expected to lead those gifted students efficiently and qualitatively. Renzulli (1968) and Sisk (1989) indicate that teachers who are specifically educated on the diagnosis of gifted learners and instructional differentiation play vital roles on the formation of sufficient learning environments that support their special needs. Under these conditions, it can be said that teachers require having some special properties to form those sufficient environments. According to Van Tassel-Baska (1991), the person who will teach gifted students must have a proper background and specified skills to support those learners at the time of their accelerating progresses, make differentiation in the course syllabus where needed, having the sufficient proficiency on expertise and educational issues, organize and create class activities.

Strip and Hirsch (2000) state that there are some beneficial qualities for the educators who are teaching gifted and talented students. These qualities can be listed as: recognize of individual differences, showing self-confidence, being flexible at source usage, being open-minded and creative, supporting the student's self-confidence, having cultural and technical knowledge, being patient and stabile, being skillful and proficient on the issues and enjoying working with gifted students. It can be said that the most basic key point affecting the self-confidence, self-sufficiency and affectivity of teachers is attitude. In this case, attitude towards science and teaching science are very important parameters in order to provide self-confidence, sufficiency to the students.

A significant interaction exists among attitude, belief and behavior. Koballa and Crawley (1985) clarify this interaction using the following example; "Elementary school teachers judged their ability to teach science to be low (belief), resulting in a dislike for science teaching (attitude) that ultimately translated into teachers who avoided teaching science (behavior)". In their research, Enochs and Riggs (1990) put forward the idea that pre-service teachers who think they are not qualified enough to do efficient science education spend less time on learning and teaching science.

Many different researchers expose the fact that scientific attitude of teachers towards science education not only affect their own performances, but also influence students' success, performance and attitude towards science courses (Altınok, 2004; Morell & Lederman, 1998; Palmer, 2001; She & Fisher, 2002; Sönmez, 2007; Washton, 1971). With respect to this point, it can be said that the classes, in which the educators develop positive attitude towards science and science education, are more efficient and yet, students produce positive attitude towards the course and the teacher and their desire about continuing studies in science and their success increase (Mattern & Schau, 2002). Thus, the knowledge about the attitude of teachers towards science and science teaching and the attempt to change it is very critical. When all these key aspects are considered, the importance of determining and resolving the negative attitudes of teachers who are teaching science to curious, gifted and talented students is arising.

In literature, researches on the scientific attitudes and self-efficacy are generally take part on pre-service elementary class and science teachers (Altınok, 2004; Aslan &Uluçınar-Sağır, 2008; Chin Chin, 2005; Demirbaş

& Yağbasan, 2006; Özkan, Tekkaya, & Çakıroğlu, 2002; Sönmez, 2007; Taşdemir & Kartal, 2013; Taşkın-Can, 2005; Türkmen, 2002; Kahyaoğlu & Yangın, 2007). Aslan and Uluçınar-Sağır (2008) study on the determination process of the scientific attitude and self-efficacy belief levels towards science teaching of elementary school pre-service teachers of science and technology; and they find out that students' self-efficacy levels and scientific attitudes do not differentiate according to genders but show significant differences depending on grade levels. A positive relation is investigated between the self-efficacy beliefs and scientific attitudes of students. On the other hand, in Kahyaoğlu & Yangın (2007)'s studies, attitudes of elementary school pre-service teachers towards science education are examined by working with the candidates of science, mathematics and elementary teaching programs. As a result of these studies, it is exposed that there aren't significant differences between the program, tuition system and grade level of pre-service teachers and their attitudes towards science education.

In their studies on elementary school teachers sand science teachers, Taşdemir & Kartal (2013) investigate the scientific attitudes of pre-service teachers according to genders, grade levels, type of the high school graduated and learning styles. At the end of the researches, investigators put forward the conclusion that scientific attitudes of students differentiate significantly due to their genders, grade levels and graduation high school; but they don't change according to pre-service teachers' learning styles. In these studies, self-efficacy, attitudes toward science and scientific attitudes of form tutors and science teachers are investigated specifically. Moreover, examining the attitude towards science teaching and this attitude's relation with other variables is as important as self-efficacy and scientific attitudes.

Especially, when it comes to the education of gifted and talented students, researcher couldn't find any study that studying the self-efficacy and scientific attitude of pre-service teachers of gifted students. Gifted students are the students who are seen favorite candidates of scientist because they have really high potential on thinking critically, creatively and they generate new knowledge. Teacher is one of the most effective factor on students point of view (self-efficacy, attitude, emotions etc.) on the major of interest especially science domain. So it is critical to determine scientific attitude and science teaching attitude levels of gifted students' teachers in order to guide the attitudes of gifted students' s on science. So

At this point, new researches are necessarily needed, in which the scientific attitudes, self-efficacy perceptions and attitudes towards science courses and science teaching of pre-service teachers of gifted people are investigated together and separately, and some predictions on the relations between the variables are made. In this respect, the main aim of this study is to determine science teaching attitudes and scientific attitudes of pre-service teachers of gifted students due to gender and grade level and also correlation among these variables.

2. Method

2.1. Research Design

In this study, screening method was used to determine science teaching attitudes and scientific attitudes of pre-service teachers of gifted students due to gender and grade level. In addition to this main aim, correlation among these variables was found out.

2.2. Participants

This research is carried out with 82 volunteer pre-service teachers who study in 1st, 3rd and 4th years of a state University's Faculty of Education Gifted Education program in Istanbul-Turkey.

Table 1. Distribution of the Participants According to Grade Level and Gender

Gender	Grade Level						Total	
	1		3		4			
	f	%	F	%	F	%	F	%
Female	24	49	13	26.5	12	24.5	49	60
Male	8	24	8	24	17	52	33	40
Total	32	39	21	26	29	35	82	100

As seen in Table 1, 60% (n=49) of the pre-service teachers participating in the research are female and 40% (n=33) are male. 39% of them study in 1st grade (n=32), 26% are in 3rd grade (n=21) and 35% are in 4th grade (n=29).

Pre-service teachers participating in the study take different science related courses in different grade levels as part of the program for the teachers of gifted children. First year students generally do not take any courses related to science or science teaching, whereas second year students take Fundamental Physics, Fundamental Chemistry, Science and Technology Laboratory Practices I-II ; and third year Science Teaching I and Science Teaching II courses.

2.3. Instruments

In the study, the form prepared for data collection consists of three parts. In the first part, personal information like gender or grade level is collected. Second part is composed of Scientific Attitude Inventory and third part is

comprised of Attitudes towards Science Teaching Scale.

2.3.1. Scientific Attitude Inventory (SAI)

Scientific Attitude Inventory, SAI II, developed by Moore and Foy (1997), is translated and modified into Turkish by Demirbaş and Yağbasan (2006) in terms of validity and reliability. The scale is composed of 40 items. They are formed in Likert scale in groups of five and the degrees of agreement to these items are classified as; "Strongly Agree", "Agree", Undecided", "Disagree" and "Strongly Disagree". 20 of the items in the scale are designated as positive and 20 of them are negative. These negative statements are scored inversely. Marks that can be got from the Scientific Attitude Inventory change from 40 to 200. Due to the analysis of validity and reliability, the Cronbach alpha reliability coefficient of the scale is found as .76. For the current study, this value is determined as .70.

2.3.2. Attitudes toward Science Teaching Scale

Attitudes towards Science Teaching Scale, which is developed by Thompson and Shringley (1986) and is translated and modified into Turkish by Özkan, Tekkaya and Çakıroğlu (2002) is used for identifying the attitudes of pre-service teachers towards science teaching. The scale is consisted of 19 items in five-level Likert-type and the degrees of agreement of the participants are classified as; "Strongly Agree", "Agree", "Undecided", "Disagree" and "Strongly Disagree". In the scale, 11 of the items are determined as positive and 8 of them are negative. These negative statements are scored inversely. Marks that can be got from the Attitudes towards Science Teaching Scale change from 19 to 95. The Cronbach alpha reliability coefficient of the scale is found as .83 and for this research, this value is determined as .86.

2.4 Data Analysis

Descriptive statistics and Pearson correlation coefficients were used in data analysis. In order to reveal the attitude differentiations of students toward science and science teaching, independent Samples T-test is applied for gender analysis and One-Way Analyses of Variance (ANOVA) is employed for grade levels. To distinguish the group or groups causing these differences seen in the variance analysis, Scheffe Test from post-hoc tests is utilized. Moreover, during the investigations on the relation between scientific attitude and attitude toward science teaching, correlation and regression analysis are performed.

3. Results

Table 2. Descriptive Values of SAI and ASTS Scores according to Gender

Gender		N	Mean	S.D.
Female	**SAI**	49	3.51*	.266
	ASTS	49	3.35**	.390
Male	**SAI**	33	3.48*	.272
	ASTS	33	3.16**	.510

*Agree, ** Neutral/Undecided

Table 3. Descriptive Values of SAI and ASTS Scores according to Grade Level

Grade		N	Mean	S.D.
1	**SAI**	32	32	3.42*
	ASTS	32	3.16**	.444
3	**SAI**	21	3.46*	.241
	ASTS	21	3.29**	.341
4	**SAI**	29	3.61*	.288
	ASTS	29	3.38**	.502

*Agree, ** Neutral/Undecided

Descriptive findings about the Scientific Attitude and Science Teaching scores due to gender are given in Table 2 and scores due to grade levels are given in Table 3. With respect to the range coefficient (4/5=0.80) that is calculated for the five-level scale (5-1=4), ranges of the option levels are found as the following: 1.00-1.79: "strongly disagree", 1.80-2.59: "disagree", 2.60-3.39: "undecided", 3.40-4.19: "agree", 4.20-5.00: "strongly agree" (Tekin, 1993).

Considering the SAI score averages of pre-service teachers based on gender variable in Table 2, it is realized that the mean score value of both males and females are in "Agree" level. On the other hand, when ASTS score averages are examined, it is seen that the level of agreement for both genders is "Undecided". In this respect, it is determined that while both male and female spre-service teachers have a good level of scientific attitude, their attitude towards science teaching is in medium level.

When examining the average scores in SAI and ASTS according to the gender variable, it is found that while the item from SAI with the highest mean value for female pre-service teachers is "If one scientist says an

idea is true, all the other scientists will believe it." (X=4.51), the item with the lowest mean value is "One of the major purposes of science is to help people live better." (X=2.10). Furthermore, while the item from SAI with the highest mean value for male pre-service teachers is "A scientist must have a good imagination to create new ideas." (X=4.39), the item with the lowest mean value is "Electronics are the examples of the really valuable products of science." (X=2.15).

While the item from ASTS with the highest mean value for both female and male pre-service teachers is "Science is as important as reading, writing and maths." (X_{Female}=3.98; X_{Male}: 3.88), the item with the lowest mean value is "Teaching science takes too much effort."(X_{Female}=2.41; X_{Male}=2.27).

When examining the SAI and ASTS score averages of students based on grade levels in Table 3, it is realized that the SAI mean score value of pre-service teachers in all grade levels are in "Agree" degree. On the other hand, when ASTS score averages for grade levels are examined, it is seen that the level of agreement for pre-service teachers of all grade levels is "Undecided". In this respect, it is determined that while pre-service teachers from all grade levels have a good level of scientific attitude, their attitude towards science teaching is in medium level.

Considering the average scores in SAI according to the grade level variable, it is found that while the item from SAI with the highest mean value for 1st year pre-service teachers is "Scientific studies are beneficial only for scientists." (X=4.47), the item with the highest mean value for 3rd pre-service teachers is "Only scientists with high education level can understand science." (X=4.52) and the item with the highest mean value for 4th year pre-service teachers is "If one scientist says an idea is true, all the other scientists will believe it." (X=4.52). Moreover, in SAI score averages, the item with the lowest mean value for 1st and 3rd year pre-service teachers is "Electronics are the examples of the really valuable products of science." ($X_{1st\ year}$=2.06; $X_{3rd\ year}$=2.24), the item with the lowest mean value for 4th year students is "One of the major purposes of science is to help people live better." (X=2.24).

When studying the average scores in ASTS according to the grade level variable, it is found that while the item from ASTS with the highest mean value for 1st and 4th year pre-service teachers is "Science is as important as reading, writing and maths." ($X_{1st\ year}$=3.84; $X_{4th\ year}$=4.10), the item with the highest mean value for 3rd year students is "I will feel uncomfortable teaching science."(X=4.00). On the other hand, in ASTS score averages, the item with the lowest mean value for all grade levels is "Teaching science takes too much effort." ($X_{1st\ year}$=2.53; $X_{3rd\ year}$=2.33; $X_{4th\ year}$=2.17).

Table 4. T-Test Results of SAI and ASTS Scores Due to the Gender

	Gender	N	Mean	S.D.	*Df*	T	p
SAI	**Female**	49	3.51*	.266	80	.537	.593
	Male	33	3.35**	.390			
ASTS	**Female**	49	3.48*	.272	80	1.879	.064
	Male	33	3.16**	.510			

Results of the independent samples t-test which is utilized in order to distinguish the significant differences based on gender factor between the SAI and ASTS score averages of per-service teachers is given in Table 4.As seen in Table 4, statistically, there aren't any significant differences between the SAI and ASTS score averages of male and female pre-service teachers due to gender factor (t_{SAI}=0.537, p>.05; t_{ASTS}=1.879, p>.05).

Table 5. ANOVA Test Results of SAI and ASTS Scores Due to Grade Levels

	Source	Sum of Squares	*Df*	Mean of Squares	F	p	Sig.
SAI	**Between Group**	.579	2	.289	4.386	.016	4-1
	Within Group	5.212	79	.066			
	Total	5.791	81				
ASTS	**Between Group**	.788	2	.394	2.008	.141	------
	Within Group	15.502	79	.196			
	Total	16.290	81				

According to the ANOVA Test results shown in Table 5, statistically, a significant difference is determined between the SAI scores of pre-service teachers (F=4.386, p<.05). On the other hand, as stated in the Scheffe Test that is used to distinguish in which groups this difference occurs, it is designated that the SAI scores of 4th grade (X=3.61) are higher than 1st grade scores (X=3.42). At this point, it can be said that the scientific attitudes of 4th grade pre-service teachers is more positive than the scientific attitudes of 1st grade.

Statistically, there aren't any significant differences between the ASTS score averages of pre-service teachers due to grade levels (F=2.008, p>.05).

Results of the correlation analysis which is utilized in order to identify whether there is a corelation between the SAI and ASTS scores of pre-service teachers is given in Table 6.

Table 6. Corelation Between the SAI and ASTS Scores

Variables	**1**	**2**
SAI	1.00	.627*
ASTS	.627*	1.00

*p<.01

Given in Table 6, according to the correlation coefficients which are calculated based on the relation level between SAI and ASTS scores, correlation between these two variables is significant at 0.01 level. At this point, it can be said that as the scientific attitude improves positively, the attitude towards science teaching will also develop in a positive way.

5. Discussion, Conclusion and Suggestions

According to the research results, it is found that the scientific attitude of pre-service teachers of gifted students is in good level and the gender factor doesn't cause a significant difference on scientific attitude. These results are analogous with the findings of Aslan & Uluçınar-Sağır (2008), Taşkın Can (2005) and Türkmen (2002). In addition, the study's results related to the attitudes of gifted students' pre-service teachers towards science teaching are parallel with the study's results of Kahyaoğlu & Yangın (2007) and no significant differences are seen according to the gender factor. In this case, whether the pre-service teacher of gifted is male or female, the scientific attitude is in good level, but the attitude toward science teaching is in medium.

It is seen that the scientific attitudes of 4th year pre-service teachers are higher than 1st year pre-service teachers related to the grade levels. This result is also analogous with many other studies in this field (Aslan & Uluçınar-Sağır, 2008; Taşdemir & Kartal, 2013). The reason for this situation may be that the students take General Physics, Chemistry, Biology, Scientific Research Methods, Science and Technology Teaching I&II and Science Laboratory Practice I&II courses till the 4th year and as a result of the knowledge and emotional improvements gained during these courses, their attitudes are affected positively. As this result is expected, it creates a limitation for the research.

When it is considered that the scientific attitude and attitude toward science teaching of teachers affect the performance, success and attitude toward science classes (She & Fisher, 2002; Sönmez, 2007; Washton, 1971), it can be said that the classes with teachers who develop positive attitude towards science and science teaching are more efficient; thus, students develop positive attitude towards science and the educator and their success and wish to continue studying science increases (Mattern & Schau, 2002). In this context, if the inborn interest in science and motivation of gifted and talented students are supported with teachers whose scientific attitudes and interests are high, these students may be more curious in science and be better science literates. Yet, it is very important that the scientific attitude of pre-service teachers of gifted people is higher and improved in more positive manners.

ASTS scores of pre-service teachers of gifted people do not differentiate in any grade level and this result is similar to the outcomes of Kahyaoğlu & Yangın's studies. (2007). As the ASTS score averages of pre-service teachers do not change in any grade level but stay constant in the "undecided" level, at the point of effectiveness of the science based course contents and methods that are given throughout the undergraduate degree, some ambiguities occurred.

Between the scientific attitude and attitude towards science teaching, a relatively high relation is put forward and it is designated that scientific attitude explains 40% of the attitude towards science teaching. Under these circumstances, while the scientific attitude scores differentiate positively on the 4th grade depending on the grade level factor, attitude towards science teaching scores do not differentiate and this shows that except the scientific attitude, all the other variables affect the attitude towards science teaching negatively.

In Enochs, Scharmann and Riggs (1995)'s study reveals that pre-service form tutors with higher experience in science have more self-efficacy on science teaching and more positive attitudes towards education than teachers with less science experience (Mulholland, Dorman & Odgers, 2004). Together with this, Palmer (2001) states that while the attitude towards science teaching is being formed, teachers' adequacy perception, science and science teaching courses they take during their education and the teaching methods in these courses play important roles. Thus, for the candidate teachers of gifted people, a strategically and technically rich learning environments, where they can experience science studies during their pre-service education, they gain the ability to struggle with complicated situations and they teach science to different students in different levels effectively and sufficiently, should be provided (Ramey-Gassert & Shroyer, 1992).

Since many teachers have difficulties in science teaching, they take it extremely complicated and feel inadequate in teaching science (Newman & Hubner, 2012). As a result of this, instead of doing exercises in

science courses, they stay dependent on course books and have boring class hours. Moreover, these negative experiences affect both the students' successes and these teachers' efficacy unfavorably, resulting in negative attitudes towards science teaching. In this manner, the perception that science is difficult and complicated must be changed by the courses taken in instructor education, giving emphasis on the nature of science, its existence and the importance in our lives.

Besides, in our country, because of the current examination system, lots of the students study class teaching or teaching for gifted people with their social sciences background from high schools. At this point, in high school, these students are already drifted apart from science based fields and form certain biases against these fields. Pre-service teachers are sensually affected by these prejudices and this causes negativity in both scientific attitude and attitude towards science teaching. In this sense, people should not make an effort to change the wrong and negative perception created that science is hard to teach and understand; but, they must strive to prevent these unfavorable ideas occur, just from the beginning. Also, starting from the pre-school period, it is very important to show that science exists in every phase of life, standing just in the middle.

According to Tobias (1992), negative interpretations of students against science courses are derived from lack of interest and motivation in science, passive positions of students in science classes, priority of grades instead of cooperative learning in lessons and giving importance to memory based learning systems rather than understanding concepts. Considering all these statements, the following suggestions can be said:

1. Beginning from primary school, the importance of science for life can be emphasized and the negative attitude and behaviors towards this course can be lessen.
2. Showing that science is totally related with daily life, students in every level can be made understand that each individual can be provided to do scientific studies, experience this process and realize the necessity of having scientific literate.
3. Science teaching based courses in faculties of education can be restructured by changing the course contents and processes regarding more practice and applications, relating these courses with life more, responding individual needs and encouraging students to learn cooperatively. Together with this, pre-service teachers can be supported to practice in laboratories, science festivals, project competitions or performance tasks formally and in science centers, science camps or studies related to nature, informally.
4. Within the scope of these courses, efficient teaching methods and techniques that can be used in science education, can be applied, especially to gifted and talented students.
5. The effectiveness of undergraduate courses devoted to science field and science teaching can be investigated by designing researches in experimental patterns.
6. The research can be repeated with half-restructured meetings that will be made with pre-service teachers

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