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Investigation of Science Teachers' Attitudes Towards Astronomy According to Some Demographic Variables

Fen Bilimleri Öğretmenlerinin Astronomiye Yönelik Tutumlarının Bazı Demografik Değişkenlere Göre İncelenmesi

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Abstract

In this study, it is aimed to investigate whether science teachers' attitudes towards astronomy differ according to demographic characteristics by using the "Astronomy Attitude Scale (AAS)" developed by Zeilik et al. (1999) and adapted to Turkish by Bilici et al. (2012). In the research, the attitudes of 135 science teachers, who work in any public and private schools in the 2018/2019 academic year, toward astronomy are determined by using the survey method and relational research method. The data were collected by sharing of the scale prepared in Google Form, in electronic media which consist of science teachers. The obtained data is analyzed by using SPSS package software. The results of the research showed that the main factors affecting the attitudes of the teachers towards astronomy are the level of education and to participate in any education or activity related to astronomy during their teaching career.

Keywords: Attitudes towards astronomy, in service science teachers, demographic variables

Özet

Bu çalışmada Zeilik ve diğ. (1999) tarafından geliştirilen ve Bilici ve diğ. (2012) tarafından Türkçeye uyarlanan "Astronomi Tutum Ölçeği (ATÖ)" kullanılarak fen bilimleri öğretmenlerinin astronomiye yönelik tutumlarının demografik özelliklere göre farklılık gösterip göstermediğinin araştırılması amaçlanmıştır. Araştırmada tarama yöntemi ve nedensel araştırma yöntemi kullanılarak 2018/2019 eğitim öğretim yılında kamu ve özel okullarda görev yapmakta olan 135 fen bilgisi öğretmeninin astronomiye yönelik tutumları belirlenmiştir. Veriler Google Form da hazırlanan ölçeğin fen bilgisi öğretmenlerinin oluşturduğu elektronik ortamlarda paylaşılarak toplanmış, elde edilen veriler SPSS paket programı ile analiz edilmiştir. Araştırma sonuçları, öğretmenlerin astronomiye yönelik tutumlarını etkileyen ana etkenlerin lisansüstü eğitim almak ve öğretmenlik kariyerleri boyunca astronomi ile ilgili herhangi bir eğitim ya da etkinliğe katılmak olduğunu göstermiştir.

Anahtar Kelimeler: Astronomiye yönelik tutum, fen bilgisi öğretmenleri, demografik değişkenler

1. Introduction

When Copernicus claimed that the world was not the center of the universe, a new worldview emerged in religion and science, and society had to adapt to this new worldview. As the old technologies were replaced by new ones, it was possible to look far away in space than ever before. The discovery that the basic elements in the stars and the clouds of gas and dust around them are the same as the elements that make up our body further deepened our connection with the cosmos.

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Scientific and technological developments that result from studies in astronomy and related fields create changes in technology, economy and society with tools, processes and software beyond our current capabilities. The applications such as personal computers, communication satellites, mobile phones, solar panels, global positioning systems (GPS) and Magnetic Resonance Imaging (MRI), which are the products of the scientific and technological developments especially in electronic and optical fields, became indispensable for our daily life.

The contributions of astronomy, which opens new horizons for humanity, are not only technological and medical practices, but also help us explore the grandeur of the universe and our place in it, and examine how we can prolong the survival of our species (National Research Council [NRC], 2010), (Bode et al., 2008).

According to the National Research Council, every citizen, who has to make informed decisions and act on these decisions, should be aware of the basic scientific content, especially on environmental issues and rapidly developing technology (NRC, 1996). A solid understanding of geology and in particular astronomy is essential to develop the scientific literacy that is sufficient to understand most issues faced by the community, such as climate change, natural hazards, and space science (Ucar, 2009). Therefore, it is important to understand and develop positive attitudes towards astronomy content, which is an important part of scientific literacy in today's community. Scientific literacy is generally developed at school and includes both science content knowledge and the ability to apply critical thinking and science process skills to daily life (NRC, 1996). Astronomy content not only facilitates the development of scientific literacy, but also helps students develop science process skills. On the other hand, understanding the concepts of astronomy is possible by making use of what is known, knowing how to ask good questions, and having a versatile and future-oriented perspective. Having these features means being individuals who have gained critical thinking skills. The introduction of the concepts of astronomy from an early age also helps students gain critical thinking skills.

It is proven that students, who have participated in astronomy-related educational activities in primary or secondary school, continue their careers in science and technology and take place in scientific discoveries (NRC, 1991). In this context, it is very important to teach astronomy to new generations, which broadens our horizons on a personal level. The importance of the astronomy education, which is used as a tool in scientific research and education, has been understood by the developed countries and they have included astronomy subjects in their curricula in order to help students encounter basic astronomy subjects at an early age. Countries such as China, Hungary, England, Portugal and Brazil are examples. In these countries, astronomy and space sciences are taught either as an independent course or in physics (Ministry of National Education [MoNE], 2010). The United States of America (USA) uses astronomy as a tool to make students love science (Tunca, 2000).

Astronomy issues have an important place not only in the curricula of other countries but also in the curricula of our country. In high school and university education programs, astronomy subjects are given a little place. Similarly, the basic concepts related to astronomy in the Science Teacher Education Undergraduate Program contains are only included in the "astronomy" course in the eighth semester. Finally, upon its decision numbered 57 and dated 18.06.2010, the Ministry of National Education made any radical changes in the content of the Astronomy and Space Sciences Curriculum adopted in 1992 and introduced the Secondary Education Astronomy and Space Sciences Curriculum (MoNE, 2010). In this published curriculum, the necessity of developing a positive attitude towards the science of astronomy in society is clearly emphasized. In addition, since many laws are the natural practice laboratory of the universe, the development of positive attitudes towards astronomy plays an active role in popularizing physics, chemistry and biology courses to students. Therefore, it is thought that determining the attitudes of individuals towards astronomy and changing their attitudes in a positive way will affect the attitudes of the society towards science (Tunca, 2000).

In their proposal published in 1994, the European Association of Astronomy Education (EAAE), stated that astronomy education should be started as early as possible, thereby avoiding the false information that students will hear from space-related media and other publications (Taşcan & Ünal, 2016).

The developments in astronomy and related sciences have made it necessary to change the curriculum of the courses in the schools and make them suitable for the age and be oriented towards the future. In our country, the basic concepts related to astronomy are included from 4th grade level to 8th grade level in the Science and Technology curriculum which was reshaped according to the structuring teaching theory in the 2004-2005 academic year (MoNE, 2004 and 2005); in 4th grade level (The shape of the Earth, the structure of the Earth), in 5th grade level (shape and size of Sun, Earth and Moon, Earth and Moon movements, phases of the Moon, day and night formation), in 7th grade level (celestial bodies, solar system, space researches) and in 8th grade level (the formation of the universe and the Earth). After the transition to the system known as 4+4+4 in the national education system of our country, the importance given to astronomy science increased and this situation made it necessary to redefine the task and the content of the course in the education of qualified people [Scientific and Technological Research Council of Turkey [TUBITAK], Vision 2023]. In the science course, which started to be implemented in 2013,

astronomy subjects started to be taught from the 3rd grade (MoNE, 2013). The Science Course Curriculum, which aims to educate all individuals as science literate, was reshaped in 2018 (MoNE, 2018). The specific objectives of the Science Curriculum, which was implemented in 2018-2019, include:

1. To gain basic knowledge about astronomy, biology, physics, chemistry, earth and environmental sciences and science and engineering applications; and
2. To adopt scientific process skills and scientific research approach in the process of discovering nature and understanding the relationship between human and environment and to find solutions to the problems encountered in these fields.

When the 2018 Science curriculum applied at 3rd to 8th grade levels is reviewed, it is seen that the first units of all grade levels are allocated to astronomy subjects. This made it necessary for teachers to have sufficient knowledge on this subject. Brunsell and Marcks (2005) stated that, when teachers did not have sufficient information, their teaching was based on low level inquiry and cookbook activities and they misinterpreted the nature of the discipline.

Elementary science teacher training program has been changed parallel to the change in curriculum of elementary education in 2005. The application of the new program for pre-service science teachers started in 2006 so astronomy has taken place as an undergraduate course in the last semester of the science teaching program since 2006 (Council of Higher Education [CoHE], 2006). Pre-service teachers started their undergraduate education in 2006 are 2010 graduates. It means that science teachers graduated before 2010 did not take astronomy courses at the undergraduate level. The results of the research conducted in our country in recent years showed that most of the science teachers could not answer the questions prepared according to the objectives in the curriculum (Taşcan & Ünal, 2016). Recently, the research together with science teachers having different demographic variables and secondary school students showed that secondary school students were very interested in astronomy and that science teachers could not answer and/or gave incorrect information to student-originated questions (Ünsal, Korkmaz & Aybek, 2017).

2. Literature

When the studies on astronomy education were examined, it was seen that the knowledge levels, misconceptions and mental models related to the astronomy concepts are widely involved (Aktamış & Çoban, 2009; Bailey & Slater, 2004; Baxter, 1989; Bektaşlı, 2013, Bektaşlı, 2014; Bisard, Aron, Francek, & Nelson, 1994; Hemenway, Straits, Wilke, & Hufnagel, 2002; Pen ˜a & Quilez, 2001, Taylor, Barker & Jones, 2003; Taşcan & Ünal, 2016; Trumper, 2000; Zeilik, Schau, Mattern, Hall, Teague, & Bisard, 1997). Most of participants on those studies were either students or preservice teachers. Our review of the literature showed that the researches, which determine the attitudes of students and pre-service teachers towards astronomy are quite limited (Bektaşlı, 2013; Bilici, Armağan, Çakır, & Yürük, 2012; De Roberts & Delanay, 1993; Jarman & McAleese, 1996, Kallery, 2001; Uçar & Demircioğlu, 2011;Zeilik, Bisard & Lee, 2002; Zeilik et al., 1997; Zeilik & Morris, 2003; Zeilik, Schau, & Mattern, 1999; Wittman, 2009).

Science teachers, who are responsible for giving astronomy subjects within the scope of science course, should have sufficient knowledge about astronomy and their attitudes should be positive, because teachers' negative attitudes towards science affect teaching practices negatively and convey their negative attitudes to their students (Czerniak & Chiarellor 1990; Jones & Carter, 2007; Westerback, 1982). Therefore, it is very important to determine and increase the attitudes of prospective teachers who will play an active role especially in educational activities.

However, in the literature about the current studies in the field of astronomy education in our country, no study was found about the attitudes of in-service science teachers towards astronomy. On the other hand, it is known that science teachers working in the Ministry of National Education in our country have graduated from several undergraduate programs and have different demographic characteristics such as gender, graduated and under graduated, participating astronomy courses etc. In science and astronomy education researches where most of the participants are students or prospective teacher, the relationships between demographic variables and attitude have been reported and shown that the demographic characteristic effect the attitude towards science (Butts & Raun, 1969; Craker, 2006; Cronin-Jones & Shaw, 1992; De Robert & Delanay, 1993; Douglas, 1979; Jones, Howe, & Rua, 2000; Kallery, 2001; Keeves & Kotte, 1992; Kotte,1992; Papanastasiou & Zembylas, 2004; Skamp, 1989; Weinburgh, 1993, Westerback, 1982; Zeilik, Schau & Mattern, 1999]. Recently, Uçar & Demircioğlu (2011) have shown that knowledge level of astronomy of science teachers varies by demographic characteristics. To the best of our knowledge, previously, no one has reported how the attitude of in-service teachers towards astronomy changed according to demographic characteristics.

In this study, it is aimed to investigate whether science teachers' attitudes towards astronomy differ according to demographic characteristics by using the "Astronomy Attitude Scale (AAS)" developed by Zeilik et al. (1999) and adapted to Turkish by Bilici et al. (2012). For this purpose, the answers to the following questions are required:

1. What are the science teachers' attitudes towards astronomy?
2. Do the science teachers' attitudes towards astronomy differ by the gender variable?
3. Do the science teachers' attitudes towards astronomy differ by the year of graduation (undergraduate) variable?
4. Do the science teachers' attitudes towards astronomy differ by the years of seniority variable?
5. Do the science teachers' attitudes towards astronomy differ according to the educational level (undergraduate/postgraduate) variable?
6. Do the science teachers' attitudes towards astronomy differ according by the variable of participation in any education/activity related to astronomy?

It is thought that the results of this research, which determines whether there is a change in the attitudes of the teachers, who took astronomy lesson and/or participated in any activity related to sky and astronomy, will contribute to the researchers who will make studies in astronomy education and will form the basis for the qualitative studies that will be done afterwards.

3. Method

In this study, it was examined whether the attitudes towards astronomy are different from some demographic variables (gender, year of graduation (undergraduate), years of seniority, level of education (undergraduate/ postgraduate) and participating any education/activity related to astronomy) according to the scores obtained from the teachers' responses to the Astronomy Attitude Scale (hereafter AAS) by using the survey method and relational research method from the descriptive research which is a quantitative research method. In the survey research method, research data was collected from a group of people who are members of the universe to define the views or characteristics (ability, perception, attitude, belief, knowledge) that a large community has. Research data basically consisted of the answers given by the members of the group to the questions asked to them. Research data was collected over a sample representing the universe instead of the entire universe (Fraenkel & Wallen, 2009).

3.1. Study Group

While the study group was determined, maximum variation sampling method which is one of the purpose sampling methods was used. With the maximum diversity sampling method, participants with different points of view regarding the situation under consideration are included (Patton, 1987). So, by using this sampling method, it has been reached the teachers who have different professional experience, gender, age, education and duties in different regions of Turkey. When the number of people to be participated in the study group were determined, the assumptions of the analysis to be applied in the analysis of the data in the research were based.

The research group consisted of all science teachers work in public and private schools in the 2018/2019 academic year. In the 2018/2019 academic year, the number of science teacher was 37150 in Turkey (Educators Trade Union, 2018). To collect data, a Google Form which consisted of AAS and demographic information form was been prepared. Demographic information form was used to determine the variable of the study such as gender, year of graduation, years of seniority, and participating any activity related to astronomy. Mentioned Google Form was shared in electronic media with science teachers from different provinces of Turkey. So, the study group consisted of all 135 science teachers, who were randomly selected and agree to participate voluntarily in the study in the 2018/2019 academic year.

The results obtained from the demographic characteristics of 135 teachers, who participated in the study, are given in Table 1.

Table 1
Demographic characteristics of 135 teachers, who participate in the study.

Variable	Level	Frequency	Percentage
Gender	Female	80	59.3
	Male	55	40.7
Year of Graduation	2010-2018	69	51.1
	2009 and before	66	48.9
Years of Seniority	1 to 5 Years	47	34.8
	6 to 10 Years	44	32.6
	11 to 15 Years	30	22.2
	16 to 21 Years	7	5.2
	21 to 25 Years	7	5.2
Level of Education	Undergraduate	95	70.4
	Postgraduate (MSc/PhD)	40	29.6
Did you ever participate in any education/activity related to astronomy?	Yes	65	48.1
	No	70	51.9

When Table 1 is examined, it is seen that 59.3% and 40.7% of the teachers, who participate voluntarily in the study and response to the questions, are female and male respectively. Teachers' graduation years vary. It is stated that about half of the teachers were graduated in and before 2009, and 34.8%, 32.6%, 22.2%, 5.2% and 5.2% had a seniority year between 1 and 5 years, between 6 and 10 years, between 11 and 15 years, between 16 and 21 years, and between 21 and 25 years respectively. It is stated that, when they are assessed in respect of their level of education, 70.4% of the teachers, who participate in the study, have the bachelor's degree, and 29.6% of them received the post-graduate education (MSc/PhD). 48% of the teachers, who participated in the research, stated that they joined an education related to astronomy and 51.9% of them stated that they did not join any education related to astronomy.

3.2. Data collection tool

"Astronomy Attitude Scale (AAS)" developed by Zeilik et al. (1994) and adapted to Turkish by Bilici et al. (2012) was used as a data collection tool in the study. Reliability coefficient (Cronbach's Alpha) of original survey was 0.86 for the pre-test and 0.92 for the post-test (Zeilik, Mattern, Hall, Teague & Bisard, 1997). The Astronomy Attitude Scale with first form 5-point Likert type, which is adapted to Turkish and shown to be a valid and reliable scale, consists of 15 items and the Cronbach alpha internal consistency coefficient is 0.80. For the current study, the Cronbach's alpha was calculated as 0.758. The reliability coefficient being greater than 0.70 is enough for the reliability of the items (Büyüköztürk, 2010). In the Turkish form of the Astronomy Attitude Scale, which has two sub-dimensions, unlike the original scale, the items under the competency dimension to understand the concepts of astronomy (items 1, 2, 4, 5, 9, 10, 12, 13 and 14) consist of items related to "difficulty" and "cognitive competencies" for understanding and learning the astronomy concepts (Factor 1). The second-dimension interest and value sizes for astronomy (Factor 2) consist of items related to "emotion" and "values" (items 3, 6, 7, 8, 11 and 15). Internal consistency coefficients for each sub-dimension of the scale were also examined. As a result of these analyzes, Cronbach alpha of sub-factors reliability coefficients were calculated as 0.858 for factor 1 and 0.786 for factor 2. Thus, it is clear that the scale has a quite high reliability in terms of factors. Cronbach's Alpha reliability coefficient of each sub dimension in AAS was found by Bilici et al. for factor1, and factor 2 as 0.71 and 0.77, respectively. For each item of the scale, which was allowed to apply before starting the study, science teachers were asked to choose the most appropriate option among the following options: "I Don't Agree Definitely," "I Don't Agree," "I'm Indecisive," "I Agree," and "I Agree Definitely". The options "I Agree Definitely," "I Don't Agree," "I'm Indecisive," "I Agree," and "I Don't Agree Definitely" are determined respectively as 1 point, 2 points, 3 points, 4 points and 5 points. Negative expressions are coded in a reverse order.

3.3. Data analysis

SPSS 23.0 software was used to analyze the data obtained from the application. In the data analysis, two independent samples t-tests were applied for cases, where there were two independent groups (gender, level of

education, whether or not to take astronomy courses during undergraduate education (year of graduation) and to participate in the activities related to sky and astronomy). One-way analysis of variance (one-way anova) was performed for cases where there were more than two groups (years of seniority groups). These parametric are based on the assumption of normality (Field, 2009; Howitt & Cramer, 2011; Thode, 2002). In order to use these tests, it is necessary to provide the assumption of normality (Mertler & Vannatta, 2005). In the study, Shapiro-Wilk statistical hypothesis test was used to test the normality assumption (Shapiro & Wilk, 1965). Descriptive statistics were obtained for the personal-demographic information of the teachers, who participated in the study.

4. Findings

In this study where the attitudes of the science teachers, who are employed in the Ministry of National Education, towards astronomy are examined. Descriptive statistics regarding the attitudes of the teachers toward astronomy are given in Table 2.

Table 2
Descriptive statistics regarding the attitudes of the teachers toward astronomy.

Astronomy attitude scale	Arithmetic mean $\bar{X}$	Standard Deviation sd
1. I have difficulty to understand astronomy because of my thinking way.	4.2296	0.75252
2. It is easy to understand the astronomy concepts.	2.5037	1.03574
3. Astronomy is not related to my daily life.	4.3259	0.75141
4. I have difficulty to answer any questions about astronomy.	3.8074	0.89356
5. I know how the analytical thinking will be used in astronomy.	2.3333	0.71236
6. I have no idea what is happening in the field of astronomy.	4.3481	0.63854
7. I like astronomy.	1.6593	0.89911
8. Learning astronomy does not help my professional life.	4.6370	0.64191
9. I feel uncomfortable in doing my astronomy homework.	4.3704	0.76041
10. I think it is difficult to understand the astronomy concepts.	3.6741	1.06385
11. I would like to take any lessons on astronomy.	1.6148	0.81024
12. I make many mistakes in explaining the astronomy concepts.	3.8963	0.72559
13. The astronomy science involves a large number of phenomena requiring memorization.	3.0593	1.12478
14. I can learn the astronomy science.	1.5778	0.62851
15. The astronomy science is not important.	4.6667	0.54636

As seen in Table 2, of 15 items of the scale, which aims to determine the attitudes of science teachers towards astronomy, the average of 3 items is lower than 2 points, and the average of 6 items is 4 points and higher, and the remaining 11 items are between 3 and 4 points. It is seen that, among these points, the items having the lowest average are item 11 (I would like to take any lessons on astronomy) and item 14 (I can learn the astronomy astronomy), while the items having the highest average are item 8 (Learning astronomy does not help my professional life) and item 15 (The astronomy science is not important). Among the items under the competency dimension to understand the astronomy concepts, the items having the lowest average are item 2 (It is easy to understand the astronomy concepts), item 5 (I know how the analytical thinking will be used in astronomy) and item 14 (I can learn the astronomy astronomy). Among the items related to "feelings" and "values" in respect of the interest and value dimensions related to astronomy, the items having the lowest average are item 7 (I like astronomy) and item 15 (The astronomy science is not important). Based on these results, it can be said that the teachers' attitudes towards astronomy are generally positive, but they think that the astronomy science is not a very-easy-to-understand.

The independent sample t-test was used to determine whether there was a difference between male and female teachers in terms of their answers to the questions in the Astronomy Attitude Scale, and the obtained results are given in Table 3.

Table 3
t-test results of science teachers' attitudes towards astronomy by gender.

Astronomy Attitude Scale	Group	n	Arithmetic mean $\bar{X}$	Standard Deviation sd	t statistics	p (probability value)
Total	Female	80	50,525	3,36013	-0,704	0,483
	Male	55	50,964	3,82469		
Factor 1	Female	80	29,238	2,77987	-1,015	0,312
	Male	55	29,764	3,20280		
Factor 2	Female	80	21,287	1,70029	0,299	0,765
	Male	55	21,200	1,62617		

When Table 3 is examined, it is seen that there is no difference between male and female teachers in terms of 5% significance level in terms of the answers given to the questions in the Astronomy Attitude Scale.

The results of the independent two samples t-test conducted to investigate whether there is any difference between the year of graduation groups in terms of the answers of the teachers to the questions specified in the Astronomy Attitude Scale are given in Table-4.

Table 4
t-test results of science teachers' attitudes towards astronomy by year of graduation.

Astronomy Attitude Scale	n	Group	Arithmetic mean $\bar{X}$	Standard Deviation sd	t statistics	p (probability value)
Total	69	2010-2018	50,3188	3,59531	-1.291	0.199
	66	2009 and before	51,1061	3,48239		
Factor 1	69	2010-2018	29,0870	2,97904	-1,471	0.144
	66	2009 and before	29,8333	2,91196		
Factor 2	69	2010-2018	21,2319	1,35196	-0,142	0.887
	66	2009 and before	21,2727	1,94972		

When Table 4 is examined, it is seen that there is no difference between the year of graduation groups at 5% significance level in total and in the sub dimensions. On the other hand, p values were calculated for each item in the AAS scale and it is seen that calculated p-value for item 10 is 0.042. Therefore, there is a difference between the year of graduation groups at 5% significance level in terms of the answers of the teachers to the question "I think that it is difficult to understand the astronomy concepts" (Item 10). Teachers, who were graduated in 2009 and before, form the group of teachers who do not have to take astronomy course during science undergraduate program. It can be stated that the teachers included in this group had difficulty in understanding astronomy issues.

It is investigated by the student t-test whether there is any difference between the level of education groups in terms of the answers of the teachers to the questions specified in the Astronomy Attitude Scale, and the obtained results are given in Table-5.

Table 5
t-test results of science teachers' attitudes towards astronomy by level of education.

Astronomy Attitude Scale	Group	n	Arithmetic mean	Standard Deviation	t statistics	P (probability value)
Total	Undergraduate	95	50,1579	3,54099	-2,924	**0,004**
	Postgraduate (Ms/PhD)	40	52,1351	3,35130		
Factor 1	Undergraduate	95	29,0947	3,05298	-2,299	**0,023**
	Postgraduate (Ms/PhD)	40	30,4054	2,62953		
Factor 2	Undergraduate	95	21,0632	1,63610	-2,070	**0,040**
	Postgraduate (Ms/PhD)	40	21,7297	1,72641		

When Table 5 is examined, it is seen that there is a significant difference between the level of education groups in the t-test results of the science teachers' attitudes towards astronomy in favor of the postgraduate groups in total and all sub-dimensions ($p < .05$). Calculated p values for each items in the scale showed that there is a difference between the level of education groups at 5% significance level in terms of the averages of the answers of the teachers to the items "Astronomy is not related to my daily life" numbered item 3 ($p = 0.012$) and "The astronomy science involves a large number of phenomena requiring memorization" numbered item 13 ($p < 0.05$). Item 13 is related to "difficulty" and "cognitive competencies" for understanding and learning the astronomy concepts (Factor 1) while item 3 is related to related to "emotion" and "values. It can be concluded that teachers who have undergraduate degrees, cannot relate astronomy subjects to their daily lives. Furthermore, it is determined that the teachers, who have undergraduate degree, do not have a clear idea in the item "The astronomy science involves a large number of phenomena requiring memorization," whereas the teachers, who received the postgraduate education, do not participate in this question.

Table 6 shows the results of the t-test conducted to investigate whether or not there is a difference between the results of the t-test performed by the teachers, who participated and did not participate in any education, activity or training on Astronomy, in terms of their answers to the Astronomy Attitude Scale.

Table 6
t-test results of science teachers' attitudes towards astronomy whether to participate any education related to astronomy or not.

Astronomy Attitude Scale	Group	n	Arithmetic mean	Standard Deviation	t statistics	P (probability value)
Total	Yes	65	51,4615	2,66972	2,434	**0.016**
	No	70	50,0000	4,10019		
Factor1	Yes	65	30,1692	2,42106	2,782	**0.006**
	No	70	28,7857	3,26107		
Factor 2	Yes	65	51,4615	2,66972	0,271	0.787
	No	70	50,0000	4,10019		

As is seen Table 6, there is a difference between the teachers who participated and did not participate in any education, activity or training on Astronomy, at 5% significance level in terms of the answers of the teachers in total and first sub-dimension ($p < .05$).Independent t-test results showed that in-service science teachers who attended any training on astronomy, had less difficulty in the questions related to "difficulty" and "cognitive competencies" for understanding and learning the astronomy concepts. On the other hand the teachers, who did not participate in any activity or education, experienced any problems such as having difficulty in understanding the astronomy concepts of, having difficulty in answering questions about astronomy, having no idea what was done in the field of astronomy and feeling uncomfortable in doing their astronomy homework. Furthermore, these teachers had negative thoughts that astronomy was not related to daily life, that astronomy science included many facts requiring memorization that astronomy science had no importance, and that learning astronomy was not beneficial to professional life.

One-way analysis of variance (ANOVA) was used to determine whether there was a difference between the years of seniority groups in terms of the answers of the teachers answers to the Astronomy Attitude Scale or not, and the obtained results are given in Table 7.

Table 7
The results of the ANOVA conducted to determine whether there was a difference between the years of seniority groups or not.

Astronomy Attitude Scale		Sum of Squares (SS)	Degree of Freedom (df)	Squares Mean	F	p
Total	Between Groups	95,181	4	23,795	1,942	0,107
	Within -Group	1592,967	130	12,254		
	Total	1688,148	134			
Factor 1	Between Groups	44,225	4	11,056	1.273	0,284
	Within -Group	1129,212	130	8,686		
	Total	1173,437	134			
Factor 2	Between Groups	13,155	4	3,289	1,193	03217
	Within -Group	358,282	130	2,756		
	Total	371,437	134			

When Table 7 is examined, it was determined that there was no statistically significant difference in terms of answers given to the questions about "Astronomy Education according to the years of seniority groups. It can be said that the attitude of in-service science teachers towards astronomy were not influenced by the seniority.

5. Conclusion and Discussion

In this study, the in-service science teachers' attitudes towards astronomy, who have any different demographic characteristics, were examined by using the "Astronomy Attitude Scale (AAS)" developed by Zeilik et al. (1999) in 1994 and adapted to Turkish by Bilici et al. (2012). The attitudes of the science teachers toward astronomy are examined in terms of the demographic variables such as their Gender, Year of Graduation, Years of Seniority, Level of education, and whether they participated in any education, activity or training related to astronomy or not.

When descriptive statistics related to the attitudes of science teachers towards astronomy are examined, it is seen that the teachers, who participated in the research, had difficulty in understanding and learning the astronomy concepts from the answers given to the items under the competency dimension to understand the astronomy concepts.

The answers of the science teachers to the relevant items of second sub dimension of the show that their attitudes towards astronomy are positive, but they think that the science of astronomy is not a very easy to understand science. It can be concluded that teachers, who cannot use their analytical thinking skills in astronomy, also had difficulty in learning the astronomy subjects.

The results of the t-test to investigate whether there is a difference between male and female teachers in terms of teachers' answers to the Astronomy Attitude Scale show that there is no difference between male and female teachers at 5% significance level. It can be concluded that there is no difference between the attitudes of male and female teachers towards astronomy, and that they have the same thoughts about the competence, interest, feelings and values of astronomy. This result is in agreement with the study reported by Uçar and Demicioğlu (2010) that of participants are pre-service teachers.

When the results of the t-test are examined in order to investigate whether there is a difference between the year of graduation groups in terms of their answers to the Astronomy Attitude Scale or not, it is seen that there is no difference between the year of graduation groups at 5% significance level in total and in the sub dimensions. On the other hand, independent t-test for item 10 showed that the group of teachers, who graduated in 2009 and before and did not take the astronomy less during the undergraduate education process of the Science Teacher Education, had difficulty in understanding astronomy subjects.

When the results of the t-test were examined to determine whether there is a difference between teachers, who have undergraduate and postgraduate degrees, in terms of their answers to the Astronomy Attitude Scale at 5% significance level, it is seen that at there is a significant difference between the level of education groups in the t-test results of the science teachers' attitudes towards astronomy in favor of the postgraduate groups in total and all sub-dimensions. This shows that attitude of in-service teachers towards astronomy influenced by the level of education

and the teachers, who have undergraduate degree, do not have accurate and sufficient information about the science of astronomy and they cannot establish a relationship between astronomy subjects and their daily lives.

Independent t-test results showed that in service science teachers who attended any training on astronomy, had less difficulty in the questions related to "difficulty" and "cognitive competencies" for understanding and learning the astronomy concepts.

When the results of the t-test conducted to investigate whether there is any difference between these, who participated and did not participate in any education activity or training on astronomy or not, it is seen that there is any difference at 5% significance level in terms of the answers of the teachers in total and first sub-dimension. It means that in service science teachers who attended any training on astronomy, had less difficulty in the questions related to "difficulty" and "cognitive competencies" for understanding and learning the astronomy concepts.

During this study, the teachers, who participated in the research were asked to indicate any kind of activity/training that they participated on astronomy. The answers of the teachers are mostly Astronomy Teacher Seminars and TUBITAK 4004 and 4005 projects. If the teachers participate in any activity/education on astronomy, this makes a positive contribution for the teachers to think that they can enjoy astronomy and to like to take any lessons on astronomy and can learn the astronomy science. Apart from the two items, the teachers, who participated in the activity related to astronomy, had positive attitudes in terms of both competence and feelings and values. The teachers, who did not participate in any activity or education related to astronomy, experienced any problems such as having difficulty in understanding the astronomy concepts of, having difficulty in answering questions about astronomy, having no idea what was done in the field of astronomy and feeling uncomfortable in doing their astronomy homework. Furthermore, these teachers were not able to relate astronomy to their daily lives, and they thought that the science of astronomy had no importance, included a large number of phenomena requiring memorization, and that astronomical learning had no benefit to their professional lives.

According to ANOVA results, it was determined that there was no difference between the seniority year groups. It can be stated that the teachers 'attitudes towards astronomy were not affected by the teachers' seniority year and all teachers who participated in the research regardless of seniority year had similar opinions.

This study showed that the main factors affecting teachers' attitudes towards astronomy included level of education level (undergraduate/postgraduate) and participating in any astronomy-related education or activity during their teaching career.

When the results obtained from the study are reviewed, following recommendations can be made:

1. The science teachers should be encouraged to get master's/doctorate degree,
2. The science teachers should be encouraged to participate in scientific activities such as workshops, seminars etc. organized by MoNE, TUBITAK and the relevant departments of the universities,
3. The science teachers should be provided with in-service training involving observations on astronomy and be encouraged to participate.

It is thought that if the students are trained by the teachers whose attitudes are positive towards astronomy, they will develop positive attitudes towards astronomy, science and the related lessons and thus their academic achievement will increase.

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