Kastamonu Education Journal, 2022, Vol. 30, No:3, 549-561
doi: 10.24106/kefdergi. 919394

| Research Article / Araştırma Makalesi |

Investigation of Science Teachers' Professional and Scientific Attitudes

Fen Bilimleri Öğretmenlerinin Mesleki ve Bilimsel Tutumlarının İncelenmesi [1]

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Keywords

1. Attitudes towards teaching profession
2. Scientific attitudes
3. In-service teachers
4. Teaching competencies
5. Science education

Anahtar Kelimeler

1. Öğretmenlik mesleğine yönelik tutum
2. Bilimsel tutum
3. Görev yapan öğretmenler
4. Öğretmen yeterlikleri
5. Fen eğitimi

Received/Başvuru Tarihi
19.04.2021

Accepted / Kabul Tarihi
15.01.2022

Abstract

Purpose: This study investigates the level of science teachers' professional and scientific attitudes, whether these variables differ according to gender and the relationship between the two variables.

Design/Methodology/Approach: It is conducted through survey design based on quantitative research. 174 science teachers (91 females and 83 males) working in public middle schools participated. The data were collected using the "Attitudes towards Teaching Profession Scale" and "Scientific Attitudes Scale". Additionally, qualitative data were collected through the "Demographic Information Form" to support quantitative findings. Descriptive statistics, independent samples t-test and Pearson correlation analysis techniques were used in quantitative data analysis. Besides, the descriptive analysis technique was used to analyze qualitative data.

Findings: Results revealed that science teachers possessed highly positive attitudes towards the teaching profession, and their scientific attitudes were at a moderate level. While female teachers' professional attitudes were more optimistic, scientific attitudes did not change by gender. There was a moderate and positive relationship between the two variables. Science teachers choose their profession mainly for affective reasons such as loving teaching. Moreover, although teachers mostly attended in-service training programs, they were not trained on nature, history or philosophy of science to improve scientific attitudes. Finally, it was discovered that TUBITAK publications were popular among science teachers.

Highlights: Although science teachers possess positive attitudes toward their profession, their scientific attitudes are moderate. Parallel to the significant changes observed in science and technology in the information age, teacher competencies have also changed rapidly. Teachers with highly positive attitudes towards their profession are open to innovations and strive more to improve themselves. As well as science teachers' attitudes towards their profession, their scientific attitudes are of great importance in the 21st century in which developing individuals who question, judge, use information technologies, and have problem-solving skills are needed for the economic and social development of societies. Only science teachers with highly positive scientific attitudes can provide their students with an understanding of science's nature, history, or philosophy. To support teachers' scientific attitudes, in-service training on science's nature, history, or philosophy can be developed, implemented, and evaluated.

Öz

Çalışmanın amacı: Bu çalışmanın amacı fen bilimleri öğretmenlerinin mesleki ve bilimsel tutumlarının hangi düzeyde olduğunu, incelenen tutum değişkenlerinin cinsiyet açısından nasıl değiştiğini ve her iki değişken arasındaki ilişkiyi incelemektir.

Materyal ve Yöntem: Nicel araştırma yaklaşımına dayalı tarama modeli kullanılarak gerçekleştirilen bu çalışmaya devlet ortaokullarında görev yapan 174 (91 kadın ve 83 erkek) fen bilimleri öğretmeni katılmıştır. Veriler "Öğretmenlik Mesleğine Yönelik Tutum Ölçeği" ile "Bilimsel Tutum Ölçeği" kullanılarak toplanmıştır. Ayrıca nicel bulguları desteklemek için "Demografik Bilgi Formu" kullanılarak nitel veriler toplanmıştır. Nicel verilerin analizinde betimsel istatistikler, bağımsız örneklemler t-testi ve Pearson korelasyon analizi teknikleri kullanılmıştır. Ek olarak, nitel verilerin analizinde betimsel analiz tekniği kullanılmıştır.

Bulgular: Araştırmanın sonucunda fen bilimleri öğretmenlerinin mesleklerine yönelik yüksek düzeyde olumlu tutuma sahip oldukları ve bilimsel tutumlarının orta seviyede olduğu görülmüştür. Kadın öğretmenlerin mesleklerine yönelik tutumlarının daha olumlu olduğu bulunurken, öğretmenlerin bilimsel tutumları cinsiyet değişkeni açısından değişiklik göstermemiştir. İki tutum değişkeni arasında orta düzeyde ve pozitif yönde anlamlı bir ilişki tespit edilmiştir. Fen bilimleri öğretmenlerinin mesleği seçme nedenleri ağırlıklı olarak öğretmeyi sevme gibi duyuşsal özellikleri içermektedir. Ayrıca katılımcıların hizmetiçi eğitimlere katılım oranının yüksek olduğu ancak bilimin doğası, bilim tarihi ya da felsefesi gibi bilimsel tutumlarını geliştirmeye yönelik eğitimler almadıkları görülmüştür. Son olarak, TÜBİTAK yayınlarının fen bilimleri öğretmenleri arasında popüler olduğu bulunmuştur.

Önemli Vurgular: Fen bilimleri öğretmenlerinin mesleklerine yönelik tutumları olumlu olmasına rağmen bilimsel tutumlarının orta seviyede olduğu bulunmuştur. Bilim ve teknolojide gözlenen önemli değişimlere paralel olarak Bilişim Çağında öğretmen yeterlikleri de hızla değişmektedir. Mesleklerine yönelik yüksek olumlu tutumlara sahip öğretmenler, yeniliklere açıktır ve kendilerini geliştirmek için daha fazla çaba gösterirler. Toplumların ekonomik ve sosyal gelişimi için sorgulayan, yargılayan, bilişim teknolojilerini kullanan ve problem çözme becerisine sahip bireyler yetiştirmenin gerekli olduğu 21. yüzyılda, fen bilimleri öğretmenlerinin mesleklerine yönelik tutumları kadar bilimsel tutumları da büyük bir önem taşımaktadır. Yalnızca olumlu bilimsel tutumlara sahip fen bilimleri öğretmenleri, öğrencilerine bilimin doğası, tarihi ve felsefesi hakkında bir anlayış kazandırabilir. Öğretmenlerin bilimsel tutumlarını geliştirmek için bilimin doğası, tarihi ve felsefesi konularında hizmet içi eğitimler geliştirilebilir, uygulanabilir ve değerlendirilebilir.

[1] This study is a part of Serpil Karaalioğlu-Çakır's master thesis under the supervision of Cansel Kadıoğlu-Akbulut.

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Citation/Alıntı: Karaalioğlu Çakır, S., & Kadioğlu Akbulut, C. (2022). Investigation of Science Teachers' Professional and Scientific Attitudes, *Kastamonu Education Journal, 30*(3), 549-561. doi: 10.24106/kefdergi. 919394

INTRODUCTION

Human beings are always curious about objects, facts and events surrounding them. When the progress of scientific knowledge is examined, it is observed that learning and teaching activities date back to ancient times. Initially, scientific studies were guided by the human endeavour to learn about nature to survive. Over time, people's pleasure while discovering their surroundings has led them to investigate, learn and convey knowledge. The knowledge developed in time was shared by founding schools where adverse opinions were presented and attempted to be proven (Topdemir & Unat, 2014). For instance, in Milesian School, founded before the Christian era, ion opinion was developed by being conveyed from generation to generation. The most famous ancient-time philosophers raised in this school were Thales (B.C. 624-548), his student Anaximander (B.C. 610-545), and his student Anaximenes (B.C. 585-525). Therefore, one of the oldest professions of human history is teaching. Although the immediate circle of an individual performed teaching at first, it became a profession in time.

Even though understanding of education has changed from ancient times, teaching has never lost its significance, and teachers have become indispensable for education systems. In the globalizing world, access to and dissemination of (scientific) information has gained more importance which in turn caused the education system to be reconsidered. Today teacher's purpose is not to impart information but to assist students in developing skills. To achieve this goal, teachers need to support making meaning of accessed information and transfer their learning to real-world settings on their own.

Only when individuals in a society have the skills required by the era can the future be shaped. The most important objective of education is that the next generations have these target skills. Here the task falls on teachers as the essential elements of the education system because they are exclusively important in raising the next generations properly and qualitatively and maintaining peace and welfare in society (Celik et al., 2018). According to Serin, Gunes and Degirmenci (2015), whether a student attains a negative or positive behaviour depends on teachers' knowledge, attitude, enthusiasm and personality. However, these features are primarily defined as cognitive, and teachers' affective reactions and attitudes towards their profession are also considered necessary (Semerci & Semerci, 2004). Competencies required by teachers include field knowledge, general knowledge and professional teaching knowledge. Teachers' personality traits, teaching styles, professional competencies and attitudes are fundamental for the effectiveness of teaching (Sural, 2013). Therefore, a teacher's affective characteristics like having positive attitudes toward the profession are also important, as well as cognitive ones such as having field knowledge.

The concept of attitude, which first appeared in social psychology research, has eventually become a study subject for many disciplines, including educational sciences. The importance of the attitude variable can be explained by its vital role in describing many behaviours in individual and social dimensions (Demirtas-Madran, 2012, p.2). It is possible to encounter different definitions of attitude in the literature. Rosenberg and Hovland's (1960, p.1) first definition is "predispositions to respond in a particular way toward a specified class of objects". Krech, Crutchfield and Ballachey (1962, p.139) also defined it similarly: "As the individual develops, his cognitions, feelings and action tendencies concerning the various objects in his world become organized into enduring systems called attitudes". Correspondingly, Smith (1968, p.458) defines attitude as "inferred dispositions, attributed to an individual, according to which his thoughts, feelings and perhaps action tendencies are organized concerning a psychological object". Moreover, Inceoglu (2010, p.13) expands the previous definitions and explains attitude as "a cognitive, affective and behavioural predisposition that individuals organize towards themselves or any object, social matter or event in their surrounding based on their experiences, knowledge, feelings and motivations".

Regarding the teaching profession as the attitude object, three components of attitude towards the profession are presented in Figure 1. Even though attitude is defined in different ways in the literature, the definitions come together in that attitude comprises three components cognitive, affective and behavioural (Krech, Crutchfield & Ballachey, 1962). Individuals' attitude-related opinions and beliefs are included in the cognitive component; positive, negative and neutral feelings in the affective component, and action tendencies in the behavioural component. Accordingly, the cognitive component involves teachers' knowledge of professional competencies like field knowledge, up-to-date pedagogical approaches, or educational technologies; the affective component includes their love for the profession, attribution of sentimental value or happiness in the classroom environment; and the behavioural component comprises of a tendency to use contemporary approaches in class or collaborate with colleagues. These three components should be consistent; in other words, each should indicate a positive attitude for the sustainability of attitudes.

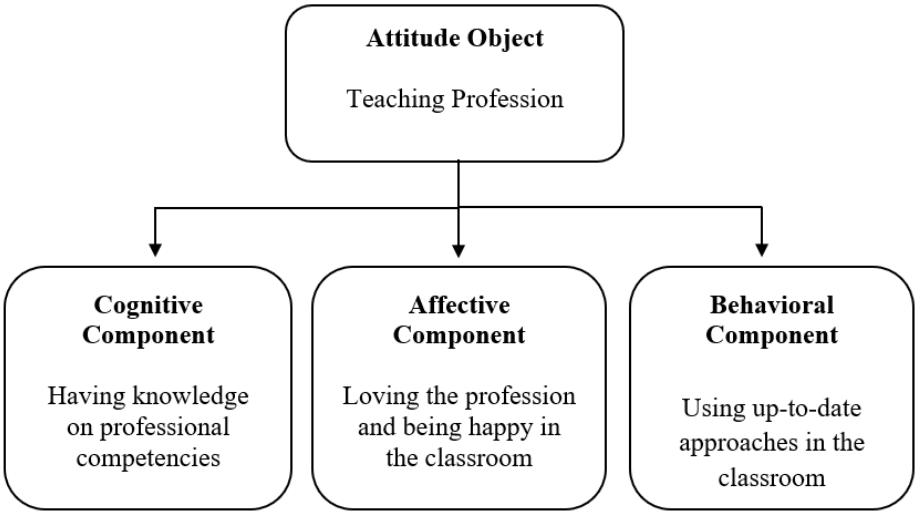


Figure 1. Three components of attitude towards teaching profession

According to Terzi and Tezci (2007), attitude and perception toward teaching are among the most important factors affecting success in the profession. Since teachers with positive professional attitudes practice the profession with love and pleasure, they endeavour more to struggle against difficulties. When teachers love their profession, they support student development in and out of the classroom. It also reflects on teachers' behaviours, and they approach students more insightfully, warmly and kindly. Likewise, Celikoz and Cetin (2004) state that a teacher with a positive professional attitude meets profession-related requirements better uses the time more efficiently and is open-minded. Furthermore, he/she helps students become more qualified individuals affecting them through more effective communication.

On the other hand, considering the current era is based on science and technology, the scientific attitudes of teachers, especially science teachers, are of great importance and their attitudes towards their profession. Basaran (1982, p.300) defines *scientific attitude* as "interpreting problems, events and situations that an individual encounters based on intellectual evidence by avoiding emotions as much as possible". When it is considered that today's students will shape the future, raising individuals with the necessary scientific and technological skills is essential. Similarly, Buyukozturk (1999) emphasizes that it is required for the objectives of the education system to include raising individuals who know how to investigate, produce and share knowledge, and have a scientific attitude. These objectives are only accomplished when teachers have the necessary scientific attitudes. These teachers are eager to follow developments in science and technology and share new information with their students. Science teachers play a vital role in developing students' scientific attitudes; they must have the proper scientific perspective.

In the literature in which attitudes towards the teaching profession are investigated, it is observed that primarily pre-service teachers' professional attitudes have been studied (Aydin & Saglam, 2012; Bozdogan, Aydin & Yildirim, 2007; Bulut, 2009; Haciomeroglu & Sahin-Taskin, 2010; Ozder, Konedrali & Zeki, 2010; Serin et al., 2015; Sundberg & Ottander, 2013; Uyanik, 2017; Ustuner, 2006). On the other hand, it is noteworthy that the number of studies with in-service teachers is limited (Bayhan, 2009; de Vocht & Laherto, 2017; Tufan, 2016). In these studies, attitude towards teaching has been examined with different variables such as teachers' self-efficacy beliefs (Dogan, 2013; Ghaith & Yaghi, 1997; Kazempour, 2014; Tufan, 2016), job satisfaction (Bayhan, 2009; Bozca, 2015; Zoroglu, 2014), teaching styles and classroom management methods (Sural, 2013). However, no research has been conducted investigating teachers' professional and scientific attitudes. As explained earlier, in the information age, for countries' development and to have a say in the future world, every country needs to raise a knowledge society that can compete in science and technology. Future citizens and prospective scientists need to understand how science works and possess positive feelings regarding scientific practice. Since science teachers are responsible for teaching scientific attitudes at schools, efforts directed at their scientific attitudes are as significant as other variables associated with science teaching. However, earlier research reveals that many teachers hold an incorrect or misleading understanding of some aspects, such as the objectivity of scientists (Abd-El-Khalick & Lederman, 2000, Cofré et al., 2019; McComas & Clough, 2020). These deficiencies implicitly lead science teachers to talk about these issues, resulting in students with an inadequate understanding of how science functions. Only teachers with high positive attitudes toward their profession can be willing to overcome these obstacles and put a high effort into improving their teaching. Besides, it is observed that studies on scientific attitude have been conducted primarily with primary education students (Afacan, 2008; Bekmezci,

2014; Canak, 2017; Gumilar, Wardani & Lisdiana, 2019), and that there has been minimal research on teachers (Bell, Mulvey & Maeng, 2016; Cakir, 2012; Hanuscin, Lee & Akerson, 2011; Kenduzer, 2017). Therefore, science teachers' scientific attitudes and attitudes toward their profession must be determined, and training programs can be developed and implemented to overcome the observed deficiencies.

This study examines in-service science teachers' professional and scientific attitudes by the relevant literature. Accordingly, the present study aims to investigate the level of science teachers' professional and scientific attitudes, whether these attitudinal variables differ according to gender, and the relationship between the two variables. In line with this purpose, answers were sought to the following questions:

1. What is the level of science teachers' attitudes towards professional and scientific attitudes?
2. Do science teachers' professional and scientific attitudes differ by gender?
3. Is there a significant relationship between science teachers' professional and scientific attitudes?
4. What are the reasons for science teachers to choose their profession?
5. What are the in-service training programs that science teachers attend?
6. What are the scientific publications that science teachers follow?

METHOD

This study, aiming to identify professional and scientific attitudes of in-service science teachers, was conducted based on survey methodology as a type of non-experimental quantitative research (Fraenkel, Wallen, & Hyun, 2012). Teachers' attitudes were measured through self-reported data.

Sample of the Study

The target population of the study involves science teachers working at public schools in Turkiye, and the sample comprises of science teachers at public schools in various districts of Tokat province. In this context, scales were distributed to all science teachers in the city center of Tokat and districts of Turhal, Pazar, Erbaa, Artova, Zile, Niksar, Almus, Yesilyurt, Sulusaray and Resadiye.

Within the scope of the study, the data were collected from a total of 174 in-service science teachers as 91 females (52.3%) and 83 males (47.7%). Participants' ages vary from 24 to 62 ($\bar{X}$ =36.41, *SD*=7.84). The district-based frequency and percentage values are presented in Table 1. Considering the number of science teachers working in the districts, difference is observed in the frequency values. The number of teachers in the central district is higher than that of other districts, and the former constitutes 40.2% of the participants. On the other hand, the number of teachers in Sulusaray is smaller compared to other districts, and the volunteer teachers here comprise of only 1.7% of the participants.

Table 1. Distribution of science teachers participating in the study based on districts where they work

District	Frequency (f)	Percentage (%)
Central	70	40.2
Erbaa	21	12.1
Turhal	20	11.5
Niksar	16	9.2
Pazar	12	6.9
Zile	11	6.3
Resadiye	7	4.0
Artova	6	3.4
Yesilyurt	5	2.9
Almus	3	1.7
Sulusaray	3	1.7
Total	174	100.0

Data Collection Tools

Three data collection tools including the Attitudes towards Teaching Profession Scale, Scientific Attitudes Scale and Demographic Information Form were used in the study.

Attitudes towards Teaching Profession Scale

To measure attitudes of science teachers towards their profession, "Attitudes towards Teaching Profession Scale" developed by Fatma Nezihe Ozgur (1994) for her dissertation under the guidance of Prof. Dr. Adil Caglar was utilized. The one-dimensional scale comprised of 33 items as 20 positive and 13 negative items (3, 5, 11, 12, 14, 20, 23, 26, 27, 28, 29, 31, 32). Ozgur (1994) calculated Cronbach Alpha internal reliability coefficient as .63.

In the 5-point Likert scale, positive attitude statements were coded as 1=strongly disagree, 2=disagree, 3=undecided, 4=agree and 5=strongly agree. As for negative attitude statements, reverse coding was performed. For instance, 1 was attained to Strongly Agree. The scores for science teachers' attitudes towards teaching profession were calculated by adding their scores from 1 to 5 for each item. Consequently, the scores for the scale varied from 33 to 165.

While calculating the level of teachers' professional attitudes, the possible score range to be obtained from the scale was divided by the number of Likert scale [Level = Possible Score Range/Likert Scale = (165-33)/5 = 26.4]. Then, the boundary values and evaluation criteria were determined by adding the value of 26.4 to the possible minimum value. Accordingly, the results between 33.0-59.4 were evaluated as "highly negative", 59.4-85.8 as "negative", 85.8-112.2 "moderate", 112.2-138.6 as "positive" and 138.6-165 as "highly positive" attitudes.

Scientific Attitudes Scale

This scale utilized to identify participants' scientific attitude was developed by Moore and Foy (1997) and adapted to Turkish by Demirbas and Yagbasan (2006). The 5-point Likert scale had 20 positive and 20 negative items as 40 items in total. The responses were coded as 1= strongly disagree, 2=disagree, 3=undecided, 4=agree and 5=strongly agree. Moore and Foy (1997) calculated the Cronbach Alpha reliability coefficient as .78 for the whole scale while Demirbas and Yagbasan (2006) calculated it as .76 in their study.

In both the original study and Turkish adaptation study, scale items were designed considering six dimensions: "Structure of scientific laws and theories", "structure of science and its manner of approaching events", "displaying scientific behavior", "structure and purpose of science", "the role and importance of science in the society" and "willingness to conduct scientific research". However, in both studies, factor analyses for validity do not support the six-dimension factor structure (Demirbas & Yagbasan, 2006; Moore & Foy, 1997). Researchers claim that it may result from teachers' lacking the necessary scientific attitudes. On the other hand, considering the total score obtained from the scale, variance is observed in scientific attitudes of both high and low scoring groups. Therefore, it is indicated that the scale can be considered as one-dimensional; accordingly, results regarding total scores of the scale were included in the present study.

Scientific attitude scores of science teachers were calculated by adding up the scores from 1 to 5 obtained from each item following the reverse coding for negative items. Accordingly, the scores for the scale varied from 40 to 200. While calculating the level of science teachers' scientific attitudes, the possible score range to be obtained from the scale was divided by the number of Likert scale [Level = Possible Score Range/Likert Scale = (200-40)/5 =32]. Then, the score of 32 was added to the possible minimum value, and boundary values and evaluation criteria were determined. Consequently, the results between 40-72 were evaluated as "highly negative", 72-104 as "negative", 104-136 as "moderate", 136-168 as "positive" and 168-200 as "highly positive" scientific attitudes.

Demographic Information Form

With the "Demographic Information Form" developed by the researchers, information on participants' gender, age and district of work was collected. In addition, participant teachers were requested to state their reasons for choosing the profession in order to examine their professional attitudes more thoroughly. Similarly, to evaluate participants' scientific attitudes, they were asked about the in-service trainings they received and scientific publications they followed.

Data Collection Process

In order to conduct research in middle schools located in the city center and districts of Tokat, first, necessary permission was received from Tokat Provincial Directorate of National Education. With the permission, school principals were visited and informed about the study, and science teachers were contacted with their help. Before distributing the scales, science teachers were ensured that the scales would be used only for research, responses would be kept confidential, and proprietary information would not be requested. The scales were distributed to teachers who volunteered to participate in the study. They responded to the items immediately and filled in the documents in the presence of the first researcher.

Data Analysis

In the analysis of quantitative data obtained from the scales, SPSS software was used. In this study based on survey model, descriptive statistics (minimum value, maximum value, mean and standard deviation) were utilized to identify the level of science teachers' professional and scientific attitudes. In order to test whether professional and scientific attitudes of science teachers differ according to gender, two separate independent samples t-tests were implemented. Independent samples t-test is used when a continuous dependent variable shows a normal distribution for each group, and independent variable is a two-level categorical variable (Buyukozturk, 2014). Assumptions of normality and homogeneity of variance are presented in the "Findings" section. To identify the relationship between professional and scientific attitudes of participants, Pearson correlation coefficients were calculated. The size of the relationship between two variables was evaluated through the criteria ($.10 \leq r \leq .30$ low, $.30 < r < .50$ medium and $r \geq .50$ high) suggested by Gravetter and Forzano (2012).

The data obtained from Demographic Information Form developed by the researchers for qualitative data analysis were analyzed through descriptive analysis. Codes deciphered as a Word document were organized, and frequency values for each code

were presented in tables in the findings section. Codes of the reasons for choosing the profession were categorized in three themes as intrinsic, extrinsic and altruistic (Akbaba, 1994; Bastick, 2000; Bruinsma & Jansen, 2010; Boz & Boz, 2008; Chou, 1996; Kasser & Ryan, 2001; Ubuz & Sari, 2008; Yu & Bieger, 2013). According to Kasser and Ryan (2001), intrinsic motives include close relationships, self-acceptance and physical health whereas extrinsic motives comprise of recognition, wealth and economic success. Akbaba (1994) describes altruism as the behavior of helping other individuals. Moreover, Chou (1996) defines altruism as voluntary and intentional behaviors that an individual exhibits for the sake of others in the society. Themes, codes and frequencies identified by considering these studies in the literature were presented in the tables. As for the in-service trainings that participants received, codes were divided into six themes based on their contents after expert opinion was taken. The themes determined (pedagogical competence, field competence, personal competence, technological competence, special education, and other) were presented in tables together with in-service training contents and frequencies. Finally, the names and frequencies of scientific publications that participants followed were also given in the tables.

FINDINGS

Descriptive statistics calculated to answer the first research question investigating the level of science teachers' professional and scientific attitudes are presented in Table 2.

Table 2. Descriptive Statistics for participants' professional and scientific attitudes

Variable	N	Possible Range	Minimum Value	Maximum Value	$\bar{X}$	SD	Level
Attitudes towards Teaching Profession	174	33-165	84	165	131.32	15.58	Positive
Scientific Attitudes	174	40-200	77	130	105.04	9.94	Moderate

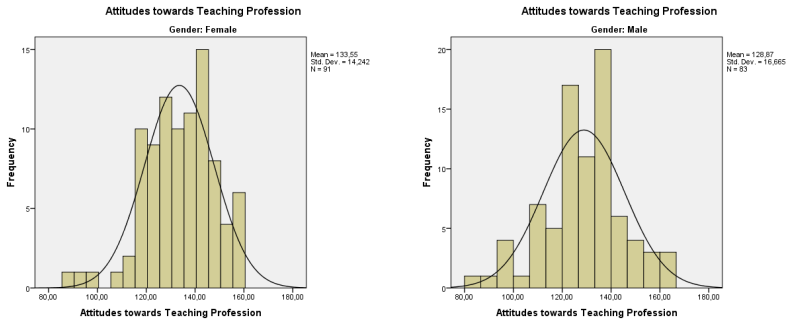
While scores of science teachers' attitudes towards their profession vary between 84 and 165, mean is 131.32 and standard deviation is 15.58. The result falls within the 112.2-138.6 score range, and it reveals that science teachers have positive attitudes.

Teachers' scientific attitude scores vary between 77 and 130 while mean is 105.04 and standard deviation is 9.94. As the mean falls within 104-136 score range, it indicates that participants' scientific attitudes are at moderate level.

In order to answer the second research question investigating whether science teachers professional and scientific attitudes differed by gender, two separate independent samples t-tests were implemented. Before interpretation of the results of the analyses, assumptions of normality and homogeneity of variance were checked for dependent variables (attitudes towards teaching and scientific attitudes). Stevens (2009) states that as a distribution's skewness and kurtosis values are closer to zero, it exhibits a normal distribution. In Table 3, it is observed that skewness and kurtosis values of both variables calculated for female and male teachers vary between (-.609) and (+.669). In addition, considering the histograms presented in Figure 2 and Figure 3, both dependent variables ensure assumption of normality for both groups. To test the assumption of homogeneity of variance, Levene's Test results were checked, and both dependent variables also met this assumption (p>.05).

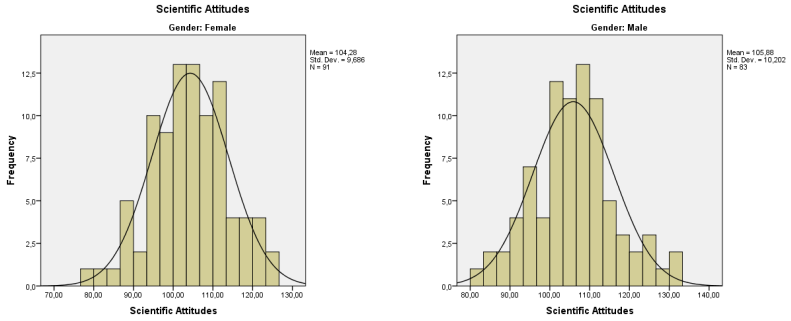
Table 3. Skewness and kurtosis values for professional and scientific attitudes by gender

Variable	Female		Male	
	Skewness	Kurtosis	Skewness	Kurtosis
Attitudes towards Teaching Profession	-.609	.669	-.325	.386
Scientific Attitudes	-.178	.201	.178	.097



(a) (b)

Figure 2. Histograms of attitudes towards teaching profession for (a) females and (b) males



(a) (b)

Figure 3. Histograms of scientific attitudes for (a) females and (b) males

After assumptions were checked, results of independent samples t-tests were interpreted (Table 4). The results revealed that attitudes of female teachers towards their profession ($\bar{X}$=133.55, *SD*=14.24) were more positive [$t(172)=1.994$, $p< .05$] than those of their male colleagues ($\bar{X}$=128.87; *SD*=16.66). On the other hand, independent samples t-test results for scientific attitude variable indicated no statistically significant difference [$t(172) = -1.06$, $p>.05$] between female ($\bar{X}$=104.28, *SD*=9.69) and male ($\bar{X}$=105.88; *SD*=10.20) teachers.

Table 4. Results of independent samples t-tests regarding science teachers' professional and scientific attitudes by gender

Variable	Gender	N	X̄	SS	sd	t	p
Attitudes towards Teaching Profession	Female	91	133.55	14.24	172	1.994	.048*
	Male	83	128.87	16.66			
Scientific Attitudes	Female	91	104.28	9.69	172	-1.06	.290
	Male	83	105.88	10.20			

*significant at p<.05 level

In order to answer the third research question inquiring the relationship between science teachers' professional and scientific attitudes, correlation analysis was performed. Pearson correlation coefficient ($r= .32$, $p< .01$) indicated that there was a moderate positive relationship between the two variables. Accordingly, scientific attitudes of science teachers with positive professional attitudes are also positive. Nevertheless, the variance determined equals to only 10.24% of the relationship between the two variables.

In the fourth research question, science teachers' reasons for choosing teaching profession were investigated to interpret their attitudes towards their profession. The codes divided into three themes as intrinsic, extrinsic, and altruistic, and presented in Table 5.

Table 5. Themes, codes, and frequencies of science teachers' reasons for choosing teaching profession

Themes	Codes	f_{male}	f_{female}	f_{total}
Intrinsic	Love for teaching	17	25	42
	Love for the profession	22	16	38
	Love for kids	8	16	24
	Love for learning	3	9	12
	Love for science	3	8	11
	Love for students	5	6	11
	Dream job	3	6	9
	Being open to development	3	4	7
	Being happy at school	-	2	2
	Love for discovery	-	1	1
	Being patient	1	-	1
	Being brave	1	-	1
	Leadership	1	-	1
Extrinsic	Getting enough scores for university replacement	16	15	31
	Ease of finding a job	14	6	20
	Impact of a role-model teacher	4	7	11
	Proper working conditions	2	9	11
	Ideal profession for females	-	8	8
	Family profession	2	5	7
	Prestigious profession	3	1	4
	Number of holidays	2	1	3

	Perception as a sacred profession	1	1	2
	Graduating from Teacher Training High School	-	2	2
	Being guided to the profession	1	1	2
	Fidelity of students	1	-	1
Altruistic	Training qualified individuals	7	5	12
	Raising individuals for the society	3	4	7
	Contribution to personal development of individuals	-	1	1

When Table 5 is examined, it is observed that, regarding the reasons for choosing the profession, participants mostly listed motives such as love for teaching (f_{male}=17, f_{female}=25), love for the profession (f_{male}=22, f_{female}=16), love for kids (f_{male}=8, f_{female}=16), love for learning (f_{male}=3, f_{female} =9) in the intrinsic theme; getting enough scores for university replacement (f_{male}=16, f_{female}=15), ease of finding a job (f_{male}= 14, f_{female}= 6), impact of a role-model teacher (f_{male}=4, f_{female}=7), proper working conditions (f_{male}=2, f_{female}=9) in the extrinsic theme; and training qualified individuals (f_{male}=7, f_{female}=5) and raising individuals for the society (f_{male}=3, f_{female}=4) in altruistic theme.

In the fifth research question, in-service trainings that participants received were investigated to interpret their scientific attitudes in detail. Among participants, 139 teachers (79.9%) stated to have taken in-service trainings whereas 35 teachers (20.1%) did not attend any program. The contents of the in-service trainings that science teachers got were divided into themes (pedagogical competence, field competence, personal competence, technological competence, special education and other) by the researchers. The themes, contents and frequencies for in-service trainings are presented in Table 6.

Table 6. Themes, contents, and frequencies for in-service trainings of science teachers

Themes	Contents of In-Service Training	f_{male}	f_{female}	f_{total}
Pedagogical Competence	Classroom Management	6	9	15
	Counselling	5	3	8
	Professional Development	7	-	7
	Teaching Techniques	1	5	6
	Assessment and Evaluation	5	2	6
	Psychology	1	-	1
Field Competence	STEM	5	4	9
	Change in Science Curriculum	3	5	8
	Methods of Science Teaching	2	5	7
	Science Laboratory Tools	2	3	5
	Material Development for Science	2	-	2
	Laboratory Use	1	1	2
	Project Development	2	-	2
Personal Competence	Occupational Safety	1	8	9
	First Aid	3	2	5
	Life Coaching	1	1	2
	Chess	1	1	2
	Communication Skills	1	1	2
	Diction	-	1	1
	Speed Reading	-	1	1
Technological Competence	Fatih Project	4	6	10
	Smart Board Use	4	2	6
	Computer	2	3	5
	Arduino	3	1	4
	EBA	2	1	3
	Software/Robotic Coding	3	-	3
	Information Technologies	2	1	3
	Internet Use	2	-	2
Special Education	Special Learning Difficulty	3	6	9
	Special Education	5	3	8
	Inclusive Students	1	2	3
	Familiarity with Gifted Students	1	1	2
	Home-Schooled Kids	1	-	1
	Gifted Kids	1	-	1
	Education for the Handicapped	1	-	1
	Autism	1	-	1

	Braille Alphabet	-	1	1
Other	Evaluation of Trainees	1	1	2
	Scholarship Exam	1	-	1
	Dormitory Management	1	-	1
	Administrative Issues	1	-	1
	School Health	-	1	1

When the responses regarding the contents of in-service trainings are evaluated, it is revealed that the most preferred trainings are classroom management (f_{male}=6, f_{female}=9) in pedagogical competence, STEM (f_{male}=5, f_{female}=4) in field competence, occupational safety (f_{male}= 1, f_{female}= 8) in personal competence, Fatih Project (f_{male}=4, f_{female}=6) in technological competence, special learning difficulty (f_{male}=3, f_{female}=6) in special education and evaluation of trainees (f_{male}=1, f_{female}=1) in other contents.

Finally, to interpret science teachers' scientific attitudes in more detail, besides the contents of in-service training programs they attended, scientific publications they followed were investigated in the sixth research question. Among participants 119 teachers (68.4%) stated to follow scientific publications whereas 55 participants (31.6%) did not. The names and frequencies of scientific publications followed by science teachers are presented in Table 7.

Table 7. Names of scientific publications that science teachers follow and their frequencies

Name of Publication	f_{male}	f_{female}	f_{total}
Science & Technique	36	39	75
Science for Kids	8	15	23
TUBITAK Publications	5	9	14
Popular Science	3	1	4
National Geographic	-	3	3
Science for Teens	2	-	2
Researcher Kid	-	2	2
Curios Kid	-	1	1
Cancer Agenda	1	-	1
Biotechnology	-	1	1
Maker	-	1	1
Instructables	1	-	1
NASA	-	1	1
Astronomy Magazines	1	-	1
Atlas	-	1	1

When the scientific publications followed by science teachers are examined, Science and Technique (f_{male}= 36, f_{female}= 39), Science for Kids (f_{male}= 8, f_{female}= 15) and other TUBITAK publications (f_{male}= 5, f_{female}= 9) are observed to be the most popular publications.

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

This study has revealed that participants have positive attitudes toward their profession, which is similar to the results of earlier studies (Akpinar, Yildiz & Ergin, 2006; Aksoy, 2010; Bozdogan, Aydin & Yildirim, 2007; Ceyhan, 2014; Ozkan, 2017; Ozder, Konedrali & Zeki, 2010). For example, in their study conducted with pre-service science teachers, Akpinar et al. (2006) discovered that participants' attitudes towards teaching were positive. Similarly, Ozkan (2017) conducted a study with pre-service science and primary teachers and identified that they also had positive attitudes towards the teaching profession.

Science teachers' reasons for choosing the profession mainly reflect compelling features such as love for teaching, the profession, kids and desire to train qualified individuals, and reveal that teachers have positive attitudes towards their profession. Furthermore, in this study, supported by qualitative data, science teachers' responses regarding reasons for choosing the profession have indicated their positive attitude towards teaching. These findings in this study are similar to other research results (Boz & Boz, 2008; Eskicumali, 2002; Ovet, 2006; Ubuz & Sari, 2008; Yong, 1995). For instance, Eskicumali (2002) conducted a study on pre-service teachers' reasons for choosing the teaching profession, and love for kids was placed near the top. Moreover, pre-service teachers indicated that their social circle and teachers affected their professional preferences. In the study by Boz and Boz (2008), motives such as love for teaching, contribution to society and love for a teacher were among the reasons why secondary school pre-service chemistry and math teachers chose the teaching profession. Similarly, in their study, Ubuz and Sari (2008) indicated that pre-service primary teachers preferred the profession based on their university entrance examination scores, the guidance of their families and social circles, their love for kids and teaching, and their perception of teaching as a sacred profession.

In previous studies, it has been observed that reasons for preferring teaching as a profession were categorized as intrinsic, extrinsic and altruistic in the light of qualitative findings (Boz & Boz, 2008; Ubuz & Sari, 2008). Identically, in this study, factors including love for the profession, kids and learning were evaluated as intrinsic motives; factors like proper working conditions, ease of finding a job and family guidance as extrinsic motives; and factors such as the desire to train individuals who are qualified and helpful to the society as altruistic motives.

In addition, when participants' attitudes towards their profession are examined by gender, it is observed that the professional attitudes of female teachers are more favourable than those of their male colleagues. Studies supporting this result are encountered in the literature (Akdag, 2014; Aksoy, 2010; Bozdogan, Aydin & Yildirim, 2007; Capri & Celikkaleli, 2008; Dogan & Coban, 2009; Ozkan, 2017; Terzi & Tezci, 2007; Uyanik, 2017). For example, Akdag (2014) studied pre-service social sciences teachers and identified that the professional attitudes of females were higher. Likewise, professional attitudes were discovered to differ significantly in favour of females in the study by Bozdogan, Aydin and Yildirim (2007). Capri and Celikkaleli (2008) revealed in their study that professional attitudes were higher in female pre-service teachers. Another study was conducted by Aksoy (2010), and it was determined that the professional attitudes of female pre-service teachers from various branches were higher than those of males. Uyanik (2017) also identified that female pre-service teachers who were senior students had more positive attitudes towards the profession. Contrary to this study, there are also studies in the literature that no difference is observed in attitudes towards the teaching profession based on gender variables (Bulut, 2009; Haciomeroglu & Taskin, 2010; Ozder, Konedrali & Zeki, 2010; Semerci & Semerci, 2004).

Qualitative findings in this study indicate that teaching is perceived as an ideal profession for females. This belief, which is quite common in our country, is one of the primary factors for females to choose teaching as a profession. The view that female provides the basis for a family also affects the choice of profession. With its working hours and holidays, teaching enables females to allocate more time for their families than other professions. Similarly, Korkut-Owen, Kepir, Ozdemir, Ozlem and Yilmaz (2012) indicate in their study that female teachers prefer teaching as a profession based on gender roles in society.

In the study, love for kids is also given as a reason for preferring the profession by females more than males. Regarding these results, it can be stated that female teachers mostly choose their profession considering affective factors. As a result, it is identified that intrinsic motives have more impact on female science teachers. Other studies also determined that intrinsic motives are more effective in females' preference for teaching as a profession (Acat & Yenilmez, 2004; Cermik, Dogan & Sahin, 2010; Manuel & Hughes, 2006; Ovet, 2006).

Regarding the reasons for choosing the profession, male teachers state more quickly finding a job after graduation than females. The common belief can also explain that males need to support their family financially more than females. Korkut-Owen et al. (2012) obtained similar results in their study and discovered that better income was a reason for preference primarily by male teachers.

On the other hand, when the scientific attitudes of science teachers are examined, they are identified to be at a moderate level. In Onen's study (2013) with pre-service science teachers, their scientific attitudes were found to be at a high level. It is an unexpected result that in-service science teachers' scientific attitudes are lower than pre-service teachers. Considering the gender variable for scientific attitude, no difference has been identified between female and male teachers. In the literature review, there are studies supporting this result (Altinok, 2004; Genc, 2001; Kenduzer, 2017).

When in-service training programs that participants attended are evaluated, it is observed that teachers who were primarily trained on pedagogical and technological subjects lacked training for developing scientific attitudes such as the ones on nature, history, or philosophy of science. Considering the workforce will rise in the information age, science teachers are expected to be more qualified in scientific attitudes. Therefore, it is necessary to conduct studies to identify in-service science teachers' misconceptions -if there are any- and improve their scientific attitudes. Indeed, science teachers' level of participation in in-service training is high, which shows that they have the potential to improve themselves with the help of future in-service training they will receive on the nature, history, or philosophy of science. Besides, science teachers' level of following scientific publications has been high. It is assumed that their knowledge will expand with scientific publications, and their moderate scientific attitudes will be improved.

When the relationship between professional and scientific attitudes of science teachers is investigated, a moderate positive relationship is identified between the two variables. Before the study, the results were anticipated to be higher by the researchers. However, when the results obtained are observed, it is revealed that they are not at the expected level. Since no sample study has been encountered in the literature, the results cannot be compared. Increasing the level of science teachers' professional and scientific attitudes with in-service training is possible.

Demographic information is presented in the study to describe participants, define the study sample limits, and inform the reader about the groups to which research findings can be transferred. In conclusion, the study is restricted to Tokat province. It is recommended that more comprehensive research be conducted with groups having different demographic features in future studies.

This study which involves science teachers working in public schools, can be expanded by including teachers who work in private schools. Besides, studies with teachers from different branches can be conducted to compare results better and evaluate teachers' professional and scientific attitudes. Finally, considering the contents of in-service training teachers received, no contents such as the nature and history of science have been encountered. In order to support teachers' scientific attitudes, training related to the functioning of science can be developed, implemented, and evaluated.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, author-ship, and/or publication of this article.

Statements of publication ethics

We hereby declare that the study has not unethical issues and that research and publication ethics have been observed carefully.

Researchers' contribution rate

The first author carried out the following processes under the supervision of the second author: conceptualization of theoretical framework, determining the research questions, designing the method, collecting the data, analyzing the data, and discussing the results. The first author wrote a Turkish draft of the manuscript on which both authors worked in cooperation. The second author edited the English version, applied the article template before submission, and submitted the manuscript to the journal. Both authors followed the publication processes and contributed to the final version of the manuscript.

Ethics Committee Approval Information

Necessary permission for the present research was received from Tokat Provincial Directorate of National Education for the first author's master's thesis (Date: 15.03.2018, Number: 5495126).

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