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THE INFLUENCES OF ELEMENTARY SCIENCE TEACHING METHOD COURSES ON A TURKISH TEACHERS COLLEGE ELEMENTARY EDUCATION MAJOR STUDENTS' ATTITUDES TOWARDS SCIENCE AND SCIENCE TEACHING

Abstract. *The main purpose of this study was to find the influences of elementary science teaching method courses on Turkish elementary education major students' attitudes toward science and science teaching in a Turkish Teachers College. The results of both pre and post-test scores showed that elementary education major students have positive attitudes toward science and science teaching. Statistically, only one significant positive change (pair-wise t-tests) was found between the pre and post-test scores; that is, students significantly gained more positive attitudes toward science teaching. On the other hand, the mean difference after taking elementary science teaching method courses did not show a significant result on the attitudes toward science. As a result of this study, it can be concluded that Elementary science teaching method courses have a positive influence on attitudes toward science teaching but this conclusion is not the same for the attitudes toward science.*

Key words: science education, elementary science teaching, attitudes toward science.

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Introduction

Turkey, like the other developing countries, pays great attention to education. The majority of Turkish people believe that reaching the level of developed and civilized countries can only be accomplished through education, especially science education. From the beginning of Turkish Republic, education is one of the main concerns of Turkish Governments. These governments have tried to make some changes mostly related to curriculum in education, according to the current conditions and trends in the world. Therefore, the latest Turkish science curriculum attempt has put more emphasize on fostering scientifically literate citizens or students who are aware of science process skills, hands on science or science for every day, have positive attitudes towards science (Ministry of National Education, 2004). Despite giving special attention to the science education, the outcome of science education is not seen at the satisfactory level in Turkey. For example, the results of two nationwide exams show that the average performance on the high school placement exam after eight-grade is 2.75 out of 25 science questions. In the university placement exam, a similar result can be seen in the science section with the average of three correct answers out of 45 questions. It means that the average achievement of students is around 10% for science questions (Milliyet, 2005). A similar result could be seen in the 2006 University Placement Exam. From the one-million five hundred thousand Turkish high school graduates entered,

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850 thousand students could not get one net correct answer in science section with 29 questions (Milliyet, 2006).

It would be necessary to find out the main reasons behind this low achievement level in the science area. Also, this question is one of the main concerns for science educators and researchers in Turkey. Related to this problem, Jelinek (1998) reported that one of the most important reasons for the low achievement seems to be students' low interest and negative attitudes toward science. A study by Haladyna, Olsen and Shaughnessy (1982) indicated similar results that showed students' feeling toward science, their achievement in science area and their future career preferences strongly correlated with students' attitudes toward science. Similar results could be seen in the studies of Oliver & Simpson (1998) and Shriley (1990) that the achievements of students in science show meaningful relation with their attitudes toward science.

Attitudinal studies in the science education area could be mainly classified into four different areas. The first area covers elementary, middle and high school students' attitudes toward science, and the effects of science courses, experiments, and scientific school visits. Additionally, under the same title, the longitudinal studies closely examine the influence of school years from the beginning to the graduation (Gibson & Chase, 2002). The second area mostly deals with college level elementary and science education students' attitudes toward science and science teaching. Additionally, in service science and elementary teachers' attitudes towards science and science teaching would be classified under the same area (McGinnis & Parker, 1999; Ediger, 2001; Turkmen, 2002). In attitudinal studies, the third area mainly compares the attitudes of students and teachers coming from different countries through an international perspective in science education (Ye, Wells, Talkmitt, & Ren, 1998). The last area closely scrutinizes the correlations of attitudes toward science and science teaching with some factors such as gender, achievement level, and socio-economic variables (Weinburgh, 2000).

The main tenets of the nature of science and attitudes toward science can be overlapped in some ways, such as the scientific view, method, and enterprise. The findings of some studies indicate that if science teachers apply the nature of science and improve students' attitudes towards science; students increase their achievements in science courses (Bloom, 1989; Brickhouse, 1992; Friend, 1985; Gabel, 1980; Moore, 1973; Moore & Foy, 1997; Munby, 1983). Therefore, the latest curriculum development of Turkey in science education has underlined the importance of attitudes toward science (MNE, 2004). As mentioned earlier, science and elementary teachers and candidates have important roles in conveying positive attitudes to the students. On the other hand, the ways of how we can make in-service and pre-service science and elementary teachers be aware of the importance of attitudes toward science as well as science teaching would not be answered easily in current teacher preparation context.

The main purpose of this study is to examine how science teaching method courses are effective to gain positive attitudes toward science and science teaching for the elementary teacher candidates in a Turkish teachers college.

Hypotheses to Be Tested

In this study, the following null hypotheses were tested.

Junior level elementary education major students do not have positive attitudes toward science and science teaching.

There is no statistically significant change in the attitudes of junior elementary education major students toward science and science teaching between fall and spring semester after taking elementary science teaching method courses I and II.

There is no statistically significant change happened between male and female junior elementary education major students' attitudes toward science and science teaching after taking elementary science teaching method courses I and II.



Theoretical Framework

In the world, from the elementary schools to colleges, science is one of the major subject courses. The current main objectives of science courses could be classified as fostering scientifically literate people who are capable of using science process skills and have positive attitudes towards science. For that reason, almost more than nine decades, attitudes towards science have been one of the main research areas in science education. Historically, the question "What is the Scientific Attitude?" was first posed by Ebel (1938) who defined both "attitude" and "scientific attitude." The definition was that "An attitude is a stabilized mental set which expresses itself in a tendency to react to any member of a class of stimuli in the same general way." Later, scientific attitudes were defined as "existence in the minds of outstanding men of science," (Ebel, 1938; Shrigley, Koballa, and Simpson, 1988).

Although attitudes towards science have an important place in science education, measuring them in science education context are not easy and have no consensus between science researchers and educators (Munby, 1983). One of the earliest scales called "A Test for Scientific Attitude." to measure attitudes was developed by Hoff (1933). After the 1960's, the number of tests measuring scientific attitudes and attitudes towards science increased. Some of them were widely used to reveal the attitudes of middle school, high school and college students, and of pre-service elementary and science teachers.

Attitudinal studies in science education area are mostly pertinent to elementary, middle and high school students', and in some cases college students' attitudes towards science. Investigating the science teaching attitudes of the teachers who are responsible for teaching science in schools is important because the importance of promoting and developing students' attitudes towards science is crucial. Studies tried to examine how teachers' attitudes correlates with students' interest, achievement, and attitudes towards science. General belief about the attitudes of teaching is that if teachers hold positive attitudes towards teaching of a field or a course, these positive attitudes should have an impact on their ways of teaching. Positive attitudes also drive their motivations and their enthusiasms for teaching higher levels (Pigge & Marso, 1997). Studies conducted on pre-service teachers or teachers' candidates indicate that if student teachers have high grades and positive attitudes, they want to enter teaching area early (Villeme & Hall, 1980). The findings of Ramsay & Ransley (1986) support the idea that teachers with positive attitudes also influenced students' achievements. The other studies covering attitudes towards teaching, in particular towards science teaching, are related to the effect of science teaching method courses, science courses, student teaching experiences, and longitudinally the differences of attitudes towards teaching between grade levels. The findings of attitudinal studies in science showed that the number of science courses which student teachers took and the differences between freshman and senior student teachers' attitude towards science teaching indicated some differences such as, the more science courses taken by student teachers, (and) the higher their education levels from freshman to senior, the more they have positive attitudes towards science teaching (Gabel, 1980; Ateaq, 1995). The study of Moore (1975) investigated another aspect of attitudes towards science teaching that whether some particular science teaching method courses as a summer workshop for elementary school teachers had any effect. In the result, some particular courses for science teaching increased attitudes towards science teaching significantly but after a certain time their attitudes again came to the initial level (Moore, 1975). Additionally, pre-service science teachers' attitude towards science and science teaching were investigated by Turkmen to reveal Turkish teachers' attitudes (1999). It showed that pre-service science teachers of Turkey held positive attitudes towards science and science teaching.

Gender seems to be one of the important predictors of students' achievement in science learning and attitudes towards science (Welch, Welberg, & Fraser, 1986; Shamai, 1996). Gender related research indicate that boys favor science courses more than girls (IAEP, 1992; Faye,



1997). An international study conducted by International Assessment of Educational Progress (IAEP, 1992) covering 20 countries and students from nine to thirteen-year old found that there was a considerable gap between male and female students for their attitudes towards science and science teaching in those countries except Taiwan and Jordan. In those countries, boys prefer mostly mathematics and physics courses while girls tend to take biology courses (Shibeci, 1984; IAPE, 1992). The same findings could be also seen in other studies that males have more positive attitudes towards science than girls. According to the report of Weinburg (2000) and Simpson and Oliver (1985), boys have significantly more positive attitudes than girls among 4000 students studying at grade 6 through 10. Besides, Jones, Howe, & Rua (2000) presented the similar results that 6th grade female students felt science courses more difficult to understand than male students did. This tendency resulted in choosing future careers of students that women made almost 15% of work force in science related areas (Chapman, 1997).

In fact, more than six decades attitudes concerning science and in some cases science teaching have an important place in science education, in the US. However, in some countries such as Israel, China, the United Kingdom, and South Korea, studies dealing with students', pre and in service science and elementary school teachers' attitude towards science and science teaching are not in a satisfactory level from the international perspective. It would be thought that this gap would be filled with the new attitudinal studies from the international arena. Therefore, it would be necessary to investigate pre-service elementary teachers' attitudes towards science as well as science teaching and the influence of science teaching method courses (elementary courses of didactics of science) on pre-service elementary teachers' scientific and science teaching attitude in a Turkish context.

Methodology of Research

The instrument used in this study was developed by Moore (1973) and it was one of the most commonly used scales to measure attitude towards science and science teaching called 'Scientific Attitude Inventory' (SAI) and Science Teaching Attitude Inventory (STAI) respectively. However, under the criticism of Munby (1983), SAI and STAI were revised and improved as SAI-II and STAS-II (Science Teaching Attitude Scale-II) by Moore and Foy (1997). Although the original form of the scale is in English and it was translated into Hebrew, Thai, Arabic, and Spanish languages (Moore & Foy, 1997), it was necessary to translate the STAS-II into Turkish for the sake of this study. Therefore, the researcher (whose native language is Turkish) translated the instrument into Turkish. Turkish students' and academics' validated the accuracy of translation, and their recommendations were considered in the final Turkish Translation.

The STAS-II has 60 statements related to science and science teaching. These statements are rated using a Likert-type scale and consist of 30 positive and 30 negative statements. The statements are also evenly divided to measure attitudes towards science and science teaching. They are also classified under eight main sub-scales, five of them are related to attitudes towards science and the other three are related to attitudes towards science teaching. Each sub-scale also has two additional sub-scales with positive (A) and negative (B) parts. Therefore, the total number of sub-scales is 16. All statements are assigned to these 16 sub-scales.

The courses instructed by the author were designed to teach some basic elements of science teaching in elementary schools to the elementary education major students in a teachers' college of Turkey. The main objectives of the courses mainly focused on the nature of science and science teaching methods. In that context, students tried to understand and discern the main tenets of the nature of science, the definition of science, how the scientific knowledge could be formed, changed, and developed by using scientific method, how science is different from other academic disciplines, the relation of science and technology as well as some aspects of contemporary science teaching methods in students centered meaning.



Data Gathering and Time Frame

This research was conducted in two sessions in a Teachers College in Turkey. Generally, when elementary education major students become junior, they have to enroll Elementary Science Teaching Method Course-I in the fall semester and Elementary Science Teaching Method Course-II in the spring semester. To collect data for the pre-test, students were asked to fill out the questionnaire during the first class session of Elementary Science Teaching Method I by the instructor. At the end of spring semester, the same procedure was repeated in order to collect data for the post-test during the last class session of Elementary Science Teaching Method Course II.

Statistical Procedure

Calculating the responses of subjects to each statement, for which maximum and minimum points are between 5 (strongly agree) and 1 (strongly disagree), made the scoring of STAS-II. After filling out the questionnaire, the responses were converted to the computer environment. Due to the instrument's (STAS-II) likert-scale feature, the range of responses was from 5 (referring the most agree) to 1 (referring the most disagree) for the positive statements, and the opposite for the negative statements (most agree 1 through most disagree 5). Finally, if the mean of attitudes is higher than 3, it is classified as positive attitude towards science and science teaching since the neutral score is 3.

The collected data was analyzed under two parts, one of which was applying pair-wise-t tests for pre and post test results that would indicate whether a significant difference can be observed before and after taking Science Teaching Method Courses (I-II). The other part was checking gender differences within pre and post-test results as well as between pre and post-test results. To run this part of statistical analyses, MANOVA (with two dependent variables (pre-test and post-test results separately) and an independent variable (gender) was used in the computer environment to get pair-wise t-test results. Independent t-tests were employed to scrutinize any significant differences between gender types for the beginning of the study as well as for the end of the study.

Participants

Data was gathered from one of the Turkish Teachers' College students whose majors and class levels were elementary education and junior, respectively. The sample size of the study was 29 female and 21 male (the total number of students is 50) elementary education students enrolled to and successfully finished both Science Teaching Method I-II Courses.

Results of Research

The study has three main parts. In the first part, research questions were answered by testing hypothesis for attitudes toward science. In the second part, the same thing was reported for attitudes toward science teaching. In the last part, attitudinal change was examined for gender. The scale employed in this study has two parts: attitudes toward science and science teaching. Also, each part has its own sub-scales. The mean scores and standard deviations of sub-scales of attitudes toward science could be seen in the following table. Additionally the differences between mean scores of pre and post-tests were presented in the following table whether significant differences exist.



Table 1. The average means and standard deviations of pre-service elementary and science teachers' attitudes towards science and pair-wise t-test results.

Sub-scales	General Contents of sub-scales in attitudes towards science	Mean		Std. Deviation		t	df	p
		Pre	Post	Pre	Post			
1A	The laws and/or theories of science are approximations of truth and are subject to change.	3.84	4.11	0.64	0.60	2.475	49	0.017 *
1B**	The laws and/or theories of science represent unchangeable truths discovered through science.	2.97	2.74	0.57	0.52	2.593	49	0.012 *
2A	Observation of natural phenomena and experimentation is the basis of scientific explanation. Science is limited in that it can only answer questions about natural phenomena and sometimes it is not able to do that.	4.07	3.99	0.72	0.65	0.716	49	0.477
2B**	The basis of scientific explanation is in authority. Science deals with all problems and it can provide correct answers to all questions	2.77	2.50	0.86	0.60	1.788	49	0.080
3A	To operate in a scientific manner, one must display such traits as intellectual honesty, dependence upon objective observation of natural events, and willingness to alter one's position on the basis of sufficient evidence.	3.84	4.05	0.81	0.57	1.699	49	0.096
3B	To operate in a scientific manner one needs to know what other scientists think; one needs to know all the scientific truths and to be able to take the side of other scientists.	4.17	4.08	0.64	0.56	0.835	49	0.408
4A	Science is an idea-generating activity. It is devoted to providing explanations of natural phenomena. Its value lies in its theoretical aspects.	3.78	3.91	0.59	0.46	1.241	49	0.221
4B**	Science is a technology-developing activity. It is devoted to serving mankind. Its value lies in its practical uses.	2.13	1.98	0.74	0.64	1.481	49	0.145
5A	Progress in science requires public support in this age of science; therefore, the public should be made aware of the nature of science and what it attempts to do. The public can understand science and it ultimately benefits from scientific work.	3.63	3.75	0.93	0.69	-0.920	49	0.362
5B	Public understanding of science would contribute nothing to the advancement of science or to human welfare; therefore, the public has no need to understand the nature of science. They cannot understand it and it does not affect them.	3.16	3.13	0.70	0.64	0.226	49	0.822
Total	Attitudes toward Science	3.47	3.44	0.32	0.23	0.557	49	0.580

* $p < 0.05$

**lower than 3 points



As mentioned previously, the scale (STAS-II) used in this study has five sub-scales on the attitudes toward science. If the mean of a sub-scale is higher than three points, it is considered that elementary teacher candidates have positive attitudes toward that part of the sub-scale. On the other hand, it is necessary to make a reminder that in negative sub-scales (Bs) if the mean score is less than three, they have negative attitudes toward these sub-scales. Also, if the mean scores are higher than three, they do not support the statements but they have positive attitudes toward those negative sub-scales. For positive sub-scales (As), the opposite should be considered.

Overall Elementary Teacher Candidates have positive attitudes toward science at the beginning. However, after taking Elementary Science Teaching Method Courses, (I and II) there is no significant change observed between pre and post test results. Elementary teacher candidates have problem to fully conceive the meaning of scientific laws and theories, and the way of getting scientific knowledge (Sub-scales 1A, 1B, 2A and 2B). They accept scientific theories and laws are changeable truths (1A). However, there is a contradiction in their attitudes that they perceive scientific theories and laws as not changeable (1B) at the same time. Pairwise t-test shows that there is only a significant change toward positive direction for sub-scale 1A and B after taking Elementary Science Teaching Method Courses (I-II) but not for the other sub-scales. The other problematic area for elementary science teacher candidates is the perception of science and technology that they conceive technology as science (Sub-scale 4B). This situation was not changed after taking Science Teaching Method Courses (I-II). In the following table, attitudes toward science teaching were examined with the same approach.

Table 2. The average mean of pre-service elementary and science teachers' attitudes towards science teaching in sub-scales.

Sub-scales	General Contents of sub-scales in attitudes towards science	Mean		Std. Deviation		t	df	p
		Pre	Post	Pre	Post			
6A	The idea of teaching science is attractive to me; I understand science and I can teach it.	3.31	3.53	0.67	0.65	2.387	49	0.021*
6B	I do not like the thought of teaching science.	3.96	4.03	0.78	0.55	-0.659	49	0.513
7A	There are certain processes in science which children should know, i.e., children should know how to do certain things.	3.79	3.88	0.48	0.43	1.034	49	0.306
7B**	There are certain facts in science that children should know.	1.85	1.96	0.51	0.75	1.050	49	0.299
8A	Science teaching should be guiding or facilitating of learning. The teacher becomes a resource person.	3.48	4.21	0.63	0.91	4.877	49	0.000*
8B**	Science teaching should be a matter of telling children what they are to learn	1.86	1.82	0.51	0.44	0.421	49	0.675
Total	Attitudes toward science teaching	3.06	3.25	0.27	0.27	4.422	49	0.000*

* $p < 0.05$

** lower than 3 point

Overall, the attitudes of elementary science teacher candidates toward science teaching show significant change after taking Elementary Science Teaching Method Courses (I-II) in a positive direction (Table 2). In the sub-scales of attitudes toward science teaching, there are some interesting points. For example, they see the function of teacher as a facilitator in sub-scale 8A. Moreover,



the mean of sub-scale 8A indicates significant change toward positive direction. On the other hand, the same teacher candidates accept that science teaching should be a matter of telling and teaching some certain facts (7B and 8B). This negative attitudinal approach was not altered even after taking Elementary Science Teaching Method Courses (I-II).

For the last research question, attitudes of pre-service elementary teachers toward science and science teaching were analyzed whether there is a significant difference between male and female pre-service elementary teachers after taking Elementary Science Teaching Method Courses (I-II)

Table 3. Male and Female Elementary Teacher Candidates' Attitudes toward Science and Science Teaching before and after Taking Science Teaching Method Courses and Independent t-test Results between Genders

Gender	N	Mean	Sd	t	df	p		
Toward Science	Pre-test	Female	29	3.36	0.22	-2.952	48	0.005*
		Male	21	3.62	0.39			
	Post-test	Female	29	3.39	0.25	-1.885	48	0.066
		Male	21	3.51	0.19			
Toward Science teaching	Pre-test	Female	29	2.98	0.26	-2.384	48	0.021*
		Male	21	3.16	0.25			
	Post-test	Female	29	3.19	0.24	-1.839	48	0.072
		Male	21	3.33	0.30			

* $p < 0.05$

At the beginning, within both attitudes toward science and science teaching, there were significant differences. However, after getting science teaching method courses, these significant differences were not observed. The reason is that at the beginning the attitudes of pre-service female elementary teachers were significantly lower than those of pre-service male elementary teachers but at the end of science teaching method courses, female pre-service teachers' attitudes were positively changed and significant differences disappeared. In the following table, these differences, whether they are significant between pre and post-tests based on gender by using pair-wise t-tests, will be reported.

Table 4. Paired-wise t-test Results of Female and Male Teachers' Attitudes toward Science and Science Teaching between Pre and Post-tests.

Section	Gender	Pre-test			Post-test			t	df	p
		N	Mean	Sd	N	Mean	Sd			
Attitudes toward Science	Female	29	3.36	0.22	29	3.39	0.25	-0.608	28	0.548
	Male	21	3.62	0.39	21	3.51	0.19	1.056	20	0.304
Toward Science teaching	Female	29	2.98	0.26	29	3.19	0.24	-3.627	28	0.001*
	Male	21	3.16	0.25	21	3.33	0.30	-2.510	20	0.021*

* $p < 0.05$

Attitudes toward science were not changed both for female and male elementary teacher candidates after taking science teaching method courses. However, attitudes toward science teaching indicate a positive significant change both for female and male elementary teacher candidates.



Discussion

This study analyzed the influence of Elementary Science Teaching Method Courses on the attitudes of pre-service elementary teachers toward science and science teaching in a Turkish Teachers' College. Especially for the science part, the sub-scales of STAS-II cover some of the major aspects of the nature of science. For the science teaching part, some of the main science teaching approaches were scrutinized.

First of all, it was found that pre-service elementary teachers have positive attitudes toward science and science teaching. Similar results were also found within the studies of Gabel (1980), Bonnstetter (1984) and Ateaq (1995) that employed the same instrument. These results could be interpreted in different ways. For example, Pigge & Marso's study (1997) shows that if pre-service or in-service elementary teachers hold positive attitudes toward science, teachers' positive attitudes toward science could influence students' attitudes positively which would increase students' achievement in science courses.

Pre-service elementary teachers' attitudes toward science were not changed even after taking Elementary Science Teaching Method Courses (I-II). In fact, as an instructor of those courses, special attention was paid to the main tenets of nature of science during the course work. On the other hand, they consider the nature of scientific knowledge as certain truths and the way of getting scientific knowledge as from certain authorities revealed in the Sub-scales of 1B and 2B (Table 1). This understanding was not changed after taking the method courses. Interestingly, at the same time, they strongly believed that scientific theories and laws are approximations and changeable truths and the way of getting scientific knowledge is based on observations revealed in Sub-scales of 1A and 2A (Table 1).

The other problematic area is the definition of science and technology; that is, pre-service elementary teachers perceive many technological works and instruments as science (Table-1, sub-scale 4B). It means that they can keep the opposite ideas related to the nature of science at the same time and this contradiction was not changed under the influence of science teaching method courses. Similar results were found in the studies of Bonnstetter (1984) and Lederman (1986).

Like attitudes toward science, attitudes toward science teaching reflects that pre-service elementary teachers hold the opposite attitudes toward certain aspects of science teaching, such as the way of teaching and what can be taught in science. For instance, they support the opposite ideas about the role of the teacher in science classes as a facilitator and at the same time as a conveyer of the certain facts in science which are revealed in Sub-scales 7A, 8A, and 8B (Table 2).

Previous studies using the same instrument (STAS-II) to measure the attitudes of pre-service science teachers (Turkmen, 1999) and newly enrolled freshman elementary education students (Turkmen, 2002) revealed similar results. In the following tables, the means of the sub-scales of STAS-II of the previous studies are compared with the results of the current study.

Table 5. Means of sub-scales of STAS-II covering attitudes toward science in three different Turkish studies.

Sub-Scales	1A	1B	2A	2B	3A	3B	4A	4B	5A	5B
Y1999	3.95	2.87	3.92	2.70	3.97	4.20	3.96	1.95	3.64	3.24
Y2002	3.87	2.90	3.91	2.60	3.83	4.08	3.72	2.04	3.78	3.27
Current	3.84	2.97	4.07	2.77	3.84	4.17	3.78	2.13	3.63	3.16



Table 6. Means of sub-scales of STAS-II covering attitudes toward science teaching in three different Turkish studies.

Sub-Scales	6A	6B	7A	7B	8A	8B
Y1999	3.85	4.30	3.77	1.81	3.87	1.93
Y2002	3.30	3.85	3.88	1.78	3.76	1.81
Current	3.31	3.96	3.79	1.85	3.48	1.86

It could be easily seen that the means of sub-scales are so closed that almost there are no differences exist although the sizes of the samples of the studies (Y1999=648, Y2002=191, and Current=50) were different. From these results, it could be thought that in Turkish context, pre-service science and elementary teachers have similar attitudes. There would be different reasons for these close means of sub-scales of STAS-II in Turkish context. One of the reasons can be related to the education system and curriculums of Turkey from elementary school level to teachers' college level nationwide. Additionally, a study conducted by Bonnstetter (1984) used the same instrument to measure Exemplary Science Teachers' attitudes toward science in the US and revealed the similar results. It could be thought that pre-service elementary and science teachers seem to hold similar attitudes toward science and science teaching. Especially the commonalities are mostly related to the nature of scientific knowledge and the definition of science and technology.

The studies of Weinburg (2000) and Simpson and Oliver (1985) reported that male students have higher level attitudes towards science than female students, as found in this study (Table 3 and 4). Additionally, between pre and post-test results, there is no significant gain observed for the attitudes toward science for female and male pre-service elementary teachers but for the attitudes toward science teaching, there is a significantly positive gain observed for female and male pre-service elementary teachers after taking Elementary Science Teaching Method Courses (Table 4). It could be concluded that especially science teaching method courses could positively influence the attitudes of female pre-service elementary teachers toward science teaching (Table 4).

Implications for Education and Suggestions

This study reveals that elementary science teaching courses seems to be not enough to change the attitudes toward science although special attention was paid to the definition of science and technology, and the nature of scientific knowledge. From this finding, it could be said that attitudes to a certain subject or area, in our study toward science and science teaching, are the result of gradual accumulation of a longitudinal process. In this study, pre-service elementary teachers' attitudes toward science teaching showed significant change after taking Elementary Science Teaching Method Courses. However, Moore (1975) reported that the attitudes of teachers toward science teaching changed significantly after taking special summer science teaching courses but after one year later, the attitudes of teachers toward science teaching came to almost the initial level. Therefore, changing attitudes toward science and science teaching positively with giving special science teaching courses or workshops is part of an iceberg in which making subjects keep the positive attitudes over the years is a core and hard concept. This implies that the development of attitudes requires long time instead of a certain period of time. For that reason, it is necessary to give special attention to develop positive attitudes of students not only in college years but in entire educational enterprise.

Further studies should examine the reasons about why pre-service elementary and science teachers hold negative attitudes for certain areas especially for the nature of scientific knowledge and why they can not differentiate between science and technology.



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Резюме

ВЛИЯНИЕ КУРСОВ МЕТОДИКИ ПРЕПОДАВАНИЯ ОСНОВ НАУК НА ОТНОШЕНИЕ СТУДЕНТОВ ТУРЕЦКОГО УЧИТЕЛЬСКОГО КОЛЛЕДЖА, СПЕЦИАЛИЗИРУЮЩИХСЯ НА НАЧАЛЬНОМ ОБУЧЕНИИ, К ЕСТЕСТВЕННЫМ НАУКАМ И ИХ ПРЕПОДАВАНИЮ

Лутфуллаг Туркмен

Целью данной работы было изучить влияние курсов методики преподавания основ естественных наук на отношение студентов одного из турецких учительских колледжей, специализирующихся на начальном обучении, к естественным наукам и их преподаванию. Результаты предварительного и последующего тестирования обнаружили у студентов, специализирующихся на начальном обучении, положительное отношение к естественным наукам и их преподаванию. Статистическим методом было найдено лишь только положительное изменение (попарные t-тесты), то есть студенты значимо приобрели более положительные установки на преподавание естественнонаучных дисциплин. С другой стороны, среднее различие результатов до и после прохождения курсов методики преподавания основ наук не указывает на значимое улучшение отношения к наукам как таковым. Результаты данного исследования позволяют заключить, что курсы методики преподавания основ естественных наук положительно влияют на отношение к их преподаванию, однако в отношении самих наук этого сказать нельзя.

Ключевые слова: естественнонаучное образование, преподавание основ естественных наук, отношение к науке.

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