Cypriot Journal of Educational Sciences

4 (2009) 33–45

www.world-education-center.org/index.php/cjes

Secondary school teacher candidates' attitudes toward science

Cengiz Aslan[a] Berna Aslan[b]*

[a]*Research Assistant at Ankara University, Faculty of Educational Sciences, 06590, Turkey*
[b]*Assistant Prof. Dr. at Ankara University, Faculty of Educational Sciences, 06590, Turkey*

Received October 20, 2008; revised May 01, 2008; accepted May 25, 2009

Abstract

Teachers are one of the most important components of students' development and it is accepted that teachers' professional and pedagogical knowledge needs to be good enough to respond to students' needs. Teachers should develop positive attitudes toward science in order to equip their students with the necessary scientific thinking abilities such as defining the problem, collecting the data, analyzing, and explaining any patterns and solving the problem. Scientific thinking abilities are important both for daily life and for the educational process. Educating students who value science could be possible as a result of educating teachers who themselves value science. In this descriptive study, the attitudes of teacher candidates with regard to science are evaluated using the Attitudes toward Science Scale, developed by Patrick A. Vitale and Brenda K. Johnson in 1988. The sample used in the study is 85 students in the field of (a) Mathematic teaching in the Department of Secondary Level Science & Mathematic Education, and (b) Turkish Language and Literature teaching at Department of Secondary Level Social Science Education. The differences in attitudes were evaluated according to some psycho-social variables gathered through a personal information form. t-test and ANOVA were used to evaluate the findings. The results indicate that students perceived the instrumental value of science and the difficulty and complexities of science differently, depending on their field of interest. Another important finding is that students who want to apply for a doctoral programme perceive the instrumental value of science differently from that of students who do not intend to apply for doctoral study. Also, the perception of the participants with regard to the difficulties and complexities of science differ according to the place they lived most of their lives in terms of rural areas, towns, cities or metropolitan.

Keywords: Science; attitude; attitudes toward science; teacher training; secondary school.

© 2009 Academic World Education & Research Center. All rights reserved.

*Corresponding Author. Berna Aslan. Tel: +90 312 363 33 50 / 3221; fax: +90312 363 61 45
E-mail address: barslan@education.ankara.edu.tr (B. Arslan), aslancengiz@yahoo.com (C. Arslan)

1. INTRODUCTION

Modern life, with its fast changing structure, forces people to make new decisions on an everyday basis. Schools are very effective tools in this process in terms of transferring the social life styles, the knowledge and the values of a culture to new generations. Central to the school system, are the students and teachers who are directly affected by this system and have an influence on it. The qualifications of the teachers are one of the main determinants of change in students' knowledge and attitudes.

The purpose in this study is to assess teacher candidates' attitudes toward science. Many of the studies dealing with attitudes toward science studies have been conducted with students aged between 12 and 20 (Gogolin and Swartz, 1992; Mellado, 1997; Aiken and Aiken, 1969). These refer to secondary school or higher education levels. Studies at the secondary school level indicate that teachers' attitudes have a great influence on students' attitudes. This reality has led us to study the attitudes of teacher candidates. Before discussing attitudes toward science we will discuss the secondary school teacher training process and consider some recent studies of teacher training in Turkey.

1.1. Teacher Training for the Secondary School Level in Turkey

The teacher training process includes such steps as the selection of the candidates, pre-service training, the practice period, in-service training, and the evaluation of each section (Kavcar 2002). Different teacher training models have been used throughout the history of Turkish education. With the Higher Education Council Act in 1981, the responsibility for teacher training institutions was given to the Higher Education Council (HEC) and from that time teacher training was carried out at the higher education level. In 1996, teacher training programmes were reorganized. The duration and the structure of teacher training programs were changed as a result of cooperation between the Higher Education Council (HEC) and the Ministry of National Education (MONE). This new programme was initially implemented in 1998-1999 academic year. One of the important changes was made with regard to the training of secondary school teachers. Two alternative ways were suggested for the training of such teachers. In the first alternative (3.5 +1.5= 5 years) the Education Faculty and the Science Faculty of a university worked together and students were enrolled in the Faculty of Education. However, in the first 7 semesters they attended courses in their subject in the Faculty of Science. After graduating, they were awarded an MA degree. In the second option (4 years +1.5 years) graduates of a faculty other than an education faculty that was accepted by the HEC, could apply for a 1.5 year long teaching certificate programme. At the end, they were awarded an MA without thesis degree (YÖK, 2007, p.54). As a result of this change, Faculty of Science students who could have become a teacher before, "…could only be a teacher if they applied for an MA without thesis programme in Educational Science Institutes" (Kavcar, 2002, p. 6).

MA without thesis programmes are organized in a number of teaching fields. HEC and MONE decide on these fields every year, depending on the schools' needs. During the programme, pedagogy courses are provided for the students. The aim of the MA without thesis programme is to provide students with professional knowledge and to give them a chance to implement their

theoretical knowledge in practice. Students must successfully complete courses worth 30 credits and undertake a term project to graduate with an MA without thesis (AÜ Eğitim Bilimleri Enstitüsü Lisansüstü Yönetmeliği, 2005). Such graduates can then become a secondary school teacher.

Secondary school covers the 14-18 years period and students' cognitive and affective developments are very rapid in this period. Teachers, as one of the important components of students' development, are a very important factor, and it is accepted that teachers' professional and pedagogical knowledge has to be good enough to respond to students' needs. Haladyna, Olsen and Shaughnessy (1982) found a significant relation between students' attitudes toward science and teacher quality and teacher commitment to learning (p.685). The quality of teachers is one of the important issues of teacher training in Turkey and there have been a number of studies in this respect. In 1999, the Teacher Competencies Commission defined the competencies for the teaching profession. This study ended in 2002 and, with regard to the fourteen identified competencies, 206 performance indicators were defined for a "teaching qualification" (Şahin, 2004). With regard to the quality of teacher training, another study was the Basic Education Support Project. This project started in September 2002 and one of the five sub-topics of the project was teacher training (others are quality of education, organization and management, mass education, communication). At the end of this project, general competencies for the teaching profession were defined. In the project web site, it is underlined that "*To educate students who are qualified, productive, sociable, and have scientific and artistic abilities; we need to educate teachers who are adequately qualified and who have the capacity to improve themselves*" (http://oyegm.meb.gov.tr/yet/). Teacher competencies include the knowledge and attitudes of the 21st Century teacher (MEB, 2009). As part of this process, teacher should have scientific understanding and discipline. They should develop positive attitudes toward science.

1.2. Attitudes towards Science

In order to truly understand the world, people need to understand science. Scientific knowledge improves our perception of the world and also enhances our intellectual level in terms of knowledge and understanding (Yıldırım, 1973, p.202). Science provides us with an early warning system (Sagan, 2000, p.39). Scientific thinking abilities are important, both for daily life and for the educational process. Educating students who value science is possible by educating teachers to value science.

People need to understand their social and physical environment in detail and, in order to do this, they have to make judgments. In daily life, judgment sources include "…traditions, authority figures, individual experiences, scientific knowledge…" (Karasar, 1999, p.5) and all of these influence the validity of our decisions.

An individual develops attitudes when he/she tries to satisfy his/her needs. Individuals organize their social relations according to a definite model of thought. In other words, people organize their social behaviours according to their intellectual patterns. This intellectual pattern of thinking is referred to as "attitudes" in social psychology (Tolan et al., 1985, p.258). Attitudes are not an inborn characteristic. People acquire them during the course of their lives (Kağıtçıbaşı, 1988, p.100). Attitudes are composed of more general forms of behaviour (Ünal, 1981, p.12) and reflect the cultural and social norms of the society in which we live. Therefore, it is important to study attitudes. These contain affective, cognitive and behavioural components (Simpson et al., 1994). There is a strong relationship between affective and cognitive components. According to Thurstone, attitudes

are positive or negative and vary in strength in terms of psychological objects. (Tolan et al., 1985, p.259).

Gardner (1975) underlines the differences between 'attitudes towards science' and 'scientific attitudes'. The latter is a complex mixture of the longing to know and understand, and having a questioning approach to all statements, a search for data and their meaning, a demand for verification, a respect for logic, a consideration of premises and a consideration of consequences (Education Policies Commission 1962, in Osborne 2003). Byrne and Johnstone (1988, in Demirbaş and Yağbasan 2005), grouped scientific attitudes into three categories as follows:

- Attitudes toward general knowledge and thought: as being curious and open minded, etc.
- Attitudes toward the evaluation of knowledge and thought: as being a critical thinker, an objective or hypothesis tester, etc.
- Attitudes toward different scientific beliefs: as adherence to the truth.

On the other hand, the attitudes toward science refer to whether a person likes or dislikes science, or has "…a positive or negative feeling about science" (Koballa & Crawley, 1985, p.223). Koballa & Crawley (1985) and Koballa (1988) found that attitudes toward science cannot be observed directly, but can be based upon descriptive beliefs. It can be observed as a positive or negative feeling about science. Koballa (1988) considers statements such as 'I like science' or 'I love to teach science' as expressions of attitudes toward science.

Teachers should develop positive attitudes toward science to equip their students with the ability to think scientifically in terms of defining the problem, collecting the data, analyzing, and explaining the pattern and solving the problem. Osborne (2003), indicated that in many attitudes towards science studies there are a range of components such as the perception of the science teacher, anxiety and self-esteem with regard to science, the value of science, motivation towards science, enjoyment of science, attitudes of peers and friends towards science, attitudes of parents towards science, the nature of the classroom environment, achievement in science, and fear of failure on a science course.

In this descriptive study, teacher candidates' attitudes towards science are investigated in terms of the different variables of gender, field of study (department), parental educational level, type of residential area, academic self-assessment, attitudes toward the teaching profession, and willingness to apply for doctoral study. Nieswandt (2005) indicated that, according to Gardner (1975) and Schibeci (1984), among all the variables that may influence attitudes toward science, gender has generally been shown to have the most consistent influence. Beginning as early as elementary school, girls show less interest in studying science than do boys (Clark, 1972; Dawson, 2000; Kotte, 1992) (in Nieswandt, 2005 p.45).

1.3. Related Research

There are many studies on attitudes toward science and the scientific attitudes of students and teachers.

Most of the "attitudes towards science" studies have been conducted with regard to students. Haladyna and Shaughnessy (1982) indicated that scientific attitudes have connoted a student's approach to thinking about science. They define it as the "cognitive attitude" or belief about thinking. In their meta-analysis, Haladyna and Shaughnessy (1982) investigated the different research into "scientific attitudes" and "attitudes toward science". Their results indicated that: (a) there are small differences in attitudes between boys and girls, (b) gender interacts slightly with many variables but in no systematic way, (c) programmes generally have a variable and positive effect on attitudes, and (d) some learning environments and teacher variables are closely related to attitude.

In a meta-analysis that focused on gender differences in attitudes, and gender differences in the relationship between attitudes toward science and achievement in science, Weinburgh (1995) found evidence that boys have a more positive attitude towards science than do girls. It was also found that for high- and low-performing girls, doing well or ''achieving'' in science was closely linked with ''liking''science (in George, 2000).

Miller (1963) compared secondary biology teachers and secondary students in terms of their understanding of science (in Lederman, 1992). Lederman said that this study is perhaps one of the better-known studies of teachers' conceptions of the nature of science. The Understanding Science (TOUS) scale, developed by Klopfer and Cooley, was used in the study. Kozlow and Nay (1976) said that TOUS is a test which is designed to measure understanding about the nature of the scientific enterprise, scientists and the methods and aims of science.

Chun and Oliver (2000) indicated that in most of the nature of science scales there is an increasing positive relationship between teachers' beliefs and their knowledge about science (in Aslan and Sağır, 2008).

Gogolin and Swartz (1992) investigated students' attitudes toward science. In their pre-test/post-test study, they applied the Attitudes towards Science Inventory (ATSI) to 102 non-science students and 81 science students. After a science course, they re-applied ATSI to the same group, and they also interviewed members of the group. The results indicated that in the pre-test, the science students not only demonstrated more positive attitudes toward science, they also showed significantly lower levels of anxiety when confronted with science-related material. They found improved attitudes and lowered anxiety levels among the non-science students after taking the science course.

Mellado (1997) studied pre-service science teachers' conception of the nature of science. He compared pre-service science teachers' conception of science and their classroom practice. He worked with four pre-service teachers, and observed their courses on the same topic. His study didn't reveal any significant connection between their conception of science and their classroom practice. However, this study is good for understanding the structure of in-depth study into the conception of the nature of science.

2. METHODOLOGY

In this descriptive study, student teachers' attitudes toward science are investigated. The population of the study is teacher candidates enrolled at the Ankara University Institute of Educational Sciences MA without thesis programme in the academic year, 2008-2009. The sample consisted of 85 students in the fields of (a) Mathematic teaching at the Department of Secondary Level Science & Mathematic Education, and (b) Turkish Language and Literature teaching at the Department of Secondary Level Social Science Education.

The translated and adapted version of the "Attitudes towards Science Scale", developed by Vitale and Johnson in 1988 was used. The scale is composed of four factors, each of which assesses the different dimensions of attitude toward science. The first factor "Instrumental Value of Science" assesses the extent to which a student perceives science as an instrumental tool, such as with regard to the effect of science in making the world a better place in which to live, or improving the standard of living in the country. A high score on factor 1 means that science had some instrumental value for the students. In the second factor, "Active Participation in Science", science activities inside and outside of the school were considered. Students who scored high on this dimension perceived science as a subject in which students participate actively. The third factor "Difficulty and Complexities of Science" deals with whether or not the students found science a difficult subject to comprehend. This factor focuses on whether students blame science for making the world too complex, and whether most of the anxiety in society today is due to science. The fourth factor, "General Attitude toward School" reflects negative feelings towards school. The factor analysis of the scale indicated that factor 1 has a reliability level of .99, while factor 2 has .81, factor 3 has .74, and factor 4 has .55 (Vitale & Johnson, 1988, p.1016). The Cronbach Alpha reliability of the Turkish version of the scale is .76.

In addition to the "Attitude towards Science Scale", a "Personal Information Form" was collected from each participant. The form included 9 questions about the participants. Information with regard to the participants' backgrounds in terms of academic department, gender, education level of the family, residential area, academic self concept, intellectual self concept, teaching profession and desire to apply for a doctoral programme was gathered through the use of this form.

3. RESULTS

In this study the researchers investigated if the teacher candidates' attitudes toward science differed according to their gender, their academic department, the education level of their family, the residential area in which they had been brought up, academic and intellectual self concept, their views on the teaching profession and their desire to apply for a doctoral programme. 88.3 % of the participants indicated that the teaching profession was suitable for them. This is a good result in terms of their general attitude towards the profession.

The results indicated that there was no significant difference among the attitudes of the participants towards science based on their gender ($t_{(83)}$= .343, p= .733), the education level of the family (mother's education $F_{(7-77)}$= .464, p= .858; father's education $F_{(5-79)}$= .518, p= .762), academic and intellectual self concept (Academic self concept $F_{(3-80)}$= .401, p= .753; intellectual self concept $F_{(2-82)}$= .176 , p= .839) and perception about the teaching profession ($F_{(3-81)}$= .637, p= .597).

On the other hand, significant differences were found between academic department and the instrumental value of science; between the academic department and the difficulty and complexities of science; the desire to apply for a doctoral programme and the instrumental value of science; and the residential area and the difficulty and complexities of science.

Table 1 shows the t-test results with regard to the participants' view on the instrumental value of science according to their academic department.

Table 1. Academic department and "Instrumental value of science"

Department	N	Mean	S	df	t	p
Turkish Language and Literature	52	61.07	.78	83	5.10	.00
Mathematics	33	55.33	.46			

The attitudes of the teacher candidates toward the instrumental value of science differed according to their field of study [t (83) = 5.10, p<.01]. The students in the Department of Turkish Language and Literature perceived the instrumental value of science more positively ($\bar{x}$ = 61.07) compared to the students in the Department of Mathematics ($\bar{x}$ = 55.33).

Table 2. Academic department and "difficulty and complexities of science"

Department	N	Mean	S	df	T	p
Turkish Language and Literature	52	8.26	2.85	83	2.68	.009
Mathematics	33	8.12	2.55			

As can be seen from the t-test results in Table 2, the teacher candidates perceived difficulty and complexities of science differently according to their department [t (83) = 2.68, p<.01]. Turkish Language and Literature students ($\bar{x}$ = 8.26) believe that science is a difficult and complex subject compared with the Mathematics students ($\bar{x}$ = 8.12).

Table 3. Desire to apply for doctoral study and "Instrumental value of science"

	N	Mean	S	df	t	p
Yes	57	60.73	4.69	83	4.86	.00
No	28	55.00	5.89			

The t-test results in Table 3 shows the relationship between the participants who want to apply for a doctoral programme and those who do not desire to apply for such a program and the conception of differences in the instrumental value of science [t (83) = 4.86, p<.01]. Those students who would like to apply for a doctoral programme perceived the instrumental value of science more positively ($\bar{x}$ = 60.73) than the others ($\bar{x}$ = 55.00).

Table 4. Residential area and "difficulty and complexities of science"

Source	Sum of Squares	df	Mean Square	F	p	Significant Difference
Between	51.189	2	25.594	3.253	.044	Town-Metropolitan city
Within	645.117	82	7.867			

Table 4 indicated the participants' residential area and differences with regard to their views on the difficulty and complexities of science [F (2–82) = 3.25, p<.05]. The results show that there was a significant difference in terms of the difficulty and complexities of science according to the residential area in which the participant were brought up. All of the participants indicated that they were brought up in town, city or metropolitan. So there aren't any participants from rural areas. The Scheffe test results showed that there is a difference between the students who were brought up in a town and those who were brought up in a metropolitan city. The perception of the difficulty and the complexities of science are higher among the participants who were brought up in a city ($\bar{x}$ = 19.93) and a town ($\bar{x}$ = 22.00) compared to the people living in the metropolitan city ($\bar{x}$ = 19.00). The students lived in a town believe that science is a difficult and complex subject to learn.

This result is consistent with the study undertaken by George (2000). In his longitudinal study, George (2000) measured changes in students' attitude toward science. He found that the students in the metropolitan city schools and the ones in rural area schools have a less positive attitude towards science than students in suburban schools.

4. DISCUSSION

In the literature, results are changing with regard to gender differences in terms of attitudes toward science (Haladyna and Shaughnessy, 1982; Weinburgh, 1995). In some studies, science is a more male-dominated field, while in others there aren't any significant results at all. Science has historically been, and still is, a male-dominated profession (National Science Foundation (1988) in George, 2000). Women tend to have negative attitudes toward science classes and toward a career in science (George, 2000). Although, in some studies, significant differences were found, the results of the present study don't indicate that there is any significant difference between male and female participants in terms of their attitudes toward science. This result would be related to the changing roles of males and females in society; there are more equal opportunities for both genders. Similarly the reason for the lack of significance in the results according to the education level of the families would be the participants' similar educational background.

Our result indicate that participants' attitudes toward science are different based on their willingness to apply for doctoral programmes, their academic departments and the residential area in which they grew up. The significant differences in terms of the views with regard to the difficulty and the complexities of science according to residential area in which they were brought up (in favour of the town), are consistent with similar research in the field. George (2000) found that the students in the metropolitan city and the ones in the rural area schools have a less positive attitudes toward science compared to students in suburban schools. The reason would be the complex nature of the metropolitan city and more curiosity of complexity among people living in the town.

Considering the departmental differences, Turkish Language and Literature students ($\bar{x}$ = 8.26) believed that science is a difficult and complex subject compared with Mathematics students ($\bar{x}$ = 8.12). The reason for this difference would be the participants' different areas of interest. Also due to the different content knowledge in their field, Turkish Language and Literature students would think that science is a complex topic.

Scientific thinking and a positive attitude toward science is becoming increasingly important in a world where fundamentalism, conservatism and ethno-centrism is increasing. Schools are very important places in which to teach scientific thinking and to disseminate universal values such as humanism, secularism and human rights. Teachers, who have a crucial role in the formal education process, should aim to develop scientific thinking abilities and positive attitudes toward science as part of their training process.

We shouldn't forget that if we want to increase the number of students with critical and scientific thinking abilities, we should increase the number of teachers with these aptitudes. This is especially the case if the science teachers haven't got any scientific inquiry abilities in that this could influence their students negatively. Students who perceive their teachers as encouraging them to take more science courses and to work hard on science, are found to report a positive attitude towards science. The teacher effect has been consistently demonstrated.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusions

In conclusion, schools are an important factor in modern life. The success level of the school is closely related to the attitudes of the students and teachers.

The attitudes of teachers towards science are important. Teachers should develop a positive attitude towards science as part of their training process. The attitudes of the teacher candidates towards science are the scope of this study. It was found that such attitudes differ significantly, especially in terms of the instrumental value of science and the difficulty and complexities of science. The departmental differences seem to be one of the important factors influencing differences in attitude toward science. Also, attitudes toward science differ according to the place that people have lived in for most of their life – town, city or the metropolitan city. Finally the students differ in their science perception according to whether or not they would like to apply for a doctoral programme.

Although the results indicated that there is no significant difference in science perception according to gender, education level of the family, academic and intellectual self concept, this does not mean that these factors are totally unrelated with attitudes toward science. This type of descriptive study should be conducted on a larger sample of teacher candidates.

5.2. Recommendations

Teachers' abilities, knowledge and attitudes need to be improved on an on-going basis in accordance with changing scientific and technological knowledge. This requires some courses and activities during pre-service preparation and in-service training of teachers. In order to improve the teacher candidates' positive attitudes towards science, courses such as general philosophy, philosophy of science, and history of science should be introduced in both the teacher training programmes and in the MA without thesis programmes. As a result, the teacher candidates' inquiry and scientific thinking abilities would be improved.

On the other hand, in order to improve attitudes toward science, the problem-solving abilities in a scientific way on the part of the teacher candidates should be developed. The teacher's scientific inquiry abilities and their knowledge of research methodologies needs to be improved. To achieve this, there should be more courses about educational research and statistics in teacher training programmes. Furthermore, the workload and credits for this kind of course should be increased. When teacher training programmes are re-organized, the results of this kind of study should be considered.

For the in-service period, regular in-service training should be organized in order to inform teachers about new scientific and educational knowledge. Also the content of educational materials should not be contrary to scientific knowledge.

REFERENCES

Aiken, L.R. & Aiken, D. R. (1969). Recent research concerning science. *Attitudes Concerning Science, 53*(4), pp. 295-305.

Aslan, O. & Sağır, U.Ş. (2008), Fen ve teknoloji öğretmen adaylarının bilimsel tutumlarının, öz yeterlik inanç düzeylerinin ve etki eden faktörlerin belirlenmesi. *Anadolu Üniversitesi 8 th International Education Technology Conference*: Eskişehir, Türkiye.

AÜ Eğitim Bilimleri Enstitüsü Lisansüstü Yönetmeliği (2005). Online received on 23.04.2009 from http://www.egitim.ankara.edu.tr

Demirbaş, M. & Yağbasan, R. (2005). Sosyal öğrenme teorisine dayalı öğretim etkinliklerinin, öğrencilerin bilimsel tutumlarının kalıcılığına olan etkisinin incelenmesi. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi 18(2),* 363-382

George, R. (2000). Measuring change in students' attitudes toward science over time: an application of latent variable growth modeling. *Journal of Science Education and Technology, 9(*3*),* pp. 213-225.

Gogolin, L. & Swartz, F. (1992). A quantitative and qualitative inquiry into the attitudes toward science of non-science college students. *Journal of Research in Science Teaching, 29*(5), pp. 487-504.

Haladyna, T. & Shaughnessy, J. (1982). Attitudes toward science: a quantitative synthesis. *Science Education 66*(4), pp. 547-563.

Haladyna, T., Olsen, R. & Shaughnessy, J. (1982). Relations of student, teacher, and learning environment variables to attitudes toward science. *Science Education, 66*(5), pp.671-687.

http://oyegm.meb.gov.tr/yet

Kağıtçıbaşı, Ç.(1996). *İnsan ve İnsanlar*. İstanbul: Evrim Yayınları .

Karasar, N. (1999). *Bilimsel Araştırma Yöntemi*. Ankara: Nobel Yayın Dağıtım.

Kavcar, C (2002*).* Cumhuriyet döneminde dal öğretmeni yetiştirme. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi*, *35*(1-2), 1-14.

Koballa, T. R., Jr. (1988). Attitude and related concepts in science education. *Science Education, 72*(2), pp.115-126.

Koballa, T. R., Jr., & Crawley, F. E. (1985). The influence of attitude on science teaching and learning. *School Science and Mathematics, 85*(3), pp.222-232.

Kozlow , M. J. & Nay, M.A. (1976). An approach to measuring scientific attitudes. *Science Education, 60*(2), pp.147-172.

Lederman, L.G. (1992). Students' and teachers' conceptions of the nature of science: a review of the research. *Journal of Research in Science Teaching. 29(*4), pp. 331-359.

MEB (2009). Online received on 23.04.2009 from http://otmg.meb.gov.tr/index.html

Millî Eğitim Bakanlığı Öğretmen Yetiştirme ve Eğitimi Genel Müdürlüğü (2008). *Öğretmen Yeterlikleri*. Ankara: Devlet Kitapları Müdürlüğü.

Mellado, V. (1997). Preservice teachers' classroom practice and their conception of the nature of science. *Science and Education, 6,* pp.331-354.

Nieswandt, M. (2005). Attitudes toward science: a review of the field. In S. Alsop (Eds.). *Beyond Cartesian Dualism* pp.41-52. Netherlands: Springer.

Osborne, J. (2003). Attitudes towards science: a review of the literature and its implications. *International Journal of Science Education, 25(*9), pp.1049-1079.

Sagan, C. (2000). *Karanlık Bir Dünyada Bilimin Mum Işığı*, Çev: Miyase Göktepeli. Ankara: Tübitak Yayınları.

Simpson, R.D., Koball T.R., Oliver, J.S., & Crawley, FE. (1994). Research on the affective dimension of science learning. In D.L. Gabel (Eds.), *Handbook of Research on Science Teaching and Learning* (pp.211-234). New York: Macmillan.

Şahin, A.E. (2004). Öğretmen yeterliklerinin belirlenmesi. *Bilim ve Aklın Aydınlığında Eğitim, 5*(58), pp.58-62.

Tolan, B. İsen G. & Batmaz V.(1985). *Ben ve Toplum*, Ankara: Teori Yayınları.

Ünal, C.(1981). *Genel Tutumların veya Değerlerin Psikolojisi Üzerine Bir Araştırma*. Ankara: AÜDTCF Yayınları No.301.

Vitale, P. A. & Johnson, B. K (1988). A factor analytic study of the attitudes of gifted secondary students toward science. *Educational and Psychological Measurement, 48*, pp.1011-1018.

Yıldırım, C. (1973). *100 Soruda Bilim Felsefesi*. İstanbul: Gerçek Yayınları.

YÖK (2007). *Öğretmen Yetiştirme ve Eğitim Fakülteleri (1982-2007)*. Yayına Hazırlayanlar: Prof. Dr. Yüksel Kavak, Prof. Dr. Ayhan Aydın, Doç. Dr. Sadegül Akbaba Altun. Meteksan:Ankara.Online: http://www.yok.gov.tr/content/view/16/lang,tr_TR/

Turkish Abstract

Ortaöğretim öğretmen adaylarının bilime yönelik tutumları

Öz: Öğrencilerin gelişimindeki en önemli öğelerden birisi olan öğretmenlerin mesleki ve pedagojik bilgi birikimlerinin öğrenci ihtiyaçlarını karşılayabilecek yeterlikte olması gerekir. Öğrencilerin problem tanımlama, veri toplama, analiz ve problem çözme gibi bilimsel düşünme becerilerini geliştirebilmeleri için öğretmenlerin bilime yönelik olumlu tutum geliştirmiş olmaları gerekir. Bilimsel düşünme becerileri, eğitsel gelişim ve günlük yaşam için önemlidir. Öğrencilerin bilime değer verebilmesi, bilime değer veren öğretmenlerin yetiştirilmesi ile mümkün olur. Tarama modelindeki bu çalışmada öğretmen adaylarının bilime yönelik tutumlarını ölçmek için Vitale ve Johnson (1988) tarafından geliştirilen Bilime Yönelik Tutum Ölçeği kullanılmıştır. Araştırmanın çalışma grubunu Matematik Öğretmenliği ve Türk Dili ve Edebiyatı Öğretmenliği bölümlerinden 85 öğrenci oluşturmaktadır. Öğretmen adaylarının tutumları arasındaki farklılıklar kişisel bilgi formu ile elde edilen bazı psiko-sosyal değişkenlere göre değerlendirilmiştir. Verilerin analizinde t-testi ve varyans analizi kullanılmıştır. Sonuçlar, öğrencilerin bilimin değeri ve bilimin zorluğu ve karmaşıklığı boyutlarında öğrenim gördükleri alanlara göre farklılaştığını göstermiştir. Çalışmadaki önemli sonuçlardan biri de doktora yapmak isteyen öğrencilerle yapmak istemeyen öğrencilerin bilime yönelik tutumları arasında farklılıklar olmasıdır. Ayrıca katılımcıların yaşadıkları yerlere göre (kırsal, şehir, metropol) bilimin zorluğu ve karmaşıklığına ilişkin algıları farklılaşmaktadır.

Anahtar Kelimeler: Bilim; tutum; bilime yönelik tutum; öğretmen eğitimi; ortaöğretim

Cypriot Journal of Educational Sciences (CJES)

Cypriot Journal of Educational Sciences (CJES) is a refereed journal published quarterly. The journal seeks to serve the Professional interests of individuals working in various educational disciplines to related theories and practices. Preferred articles; experimental researches, reporting educational researches, suggested models, reviews of recent literature should be relevant to educational concerns and issues.

Journal Details

- ***Cypriot Journal of Educational Sciences*** is an academic journal which is sponsored by Near East University and Cyprus Educational Sciences Association.
- Published By: **Academic World Education and Research Center**
- Frequency: 4 issues (*March 31, June 30, September 30, and December 31)* per year (after May 2009).
- ISSN: 1035-905X

Abstracting/ Indexing

Cypriot Journal of Educational Sciences is listed in many scholarly citation indexes (Ulrich's, Educational Research Abstracts (ERA), EBSCO, PsycINFO and Google Scholar).

Acceptance Rate

The acceptance rate for Cypriot Journal of Educational Sciences is 36.2% (December 2009).

Editorial Team

Editor-in-Chief

Huseyin Uzunboylu, Near East University, Cyprus

Editorial Board

Huseyin Uzunboylu, Near East University, Cyprus
Assist. Prof. Dr. Cigdem Hursen, Cyprus
Iztok Devetak, University of Ljubljana, Slovenia

International Advisory Board

, Bahcesehir University, Turkey
Christopher Boyle, Charles Sturt University, Australia
Othman Alsawaie, United Arab Emirates University, United Arab Emirates
Mashael Abdullah Al-Hamly, Kuwait University, Kuwait
Muammer Caltik, Blacksea Techical University, Turkey
Kanji Akahori, Hakuoh University, Japan
Helen Gunter, University of Manchester, United Kingdom
Iztok Devetak, University of Ljubljana, Slovenia
Donald Wilson Zimmerman, Carleton University, Canada
Evridiki Zachopoulou, Democritus University of Thrace, Greece
John Cowan, Edinburgh Napier University, United Kingdom
Ahmet Guneyli, Near East University, Cyprus
Jere T. Humphreys, Arizona State University, United States
Alison Sheila Taysum, University of Leicester, United Kingdom
Marissa Silverman, Montclair State University, United States
Josie Maria Rodriguez Corral, University of Cádiz (Spain), Spain
Colette Gray, Stranmillis University College, Ireland
Madhumita Bhattacharya, Athabasca University & Massey University, Canada
Jafar Yaghoubi, Zanjan University, Iran, Islamic Republic Of

Margaret Zeegers, University of Ballarat, Australia
Paulo Jorge Santos, Faculty of Arts, Porto University, Portugal, Portugal
David Wyss Rudge, Western Michigan University, United States
Diana Perez-Marin, Universidad Rey Juan Carlos, Spain
Chong Ho Yu, Arizona State University, United States
Chia-Hao Yang, Chaoyang University of Technology, Taiwan
John CK Wang, National Institute of Education, Singapore
Giuliana Dettori, ITD-CNR, Italy
Cavide Demirci, Osmangazi University, Turkey
Cristina Daskagiani, Greece
Christine Elizabeth Corcoran, University of Birmingham, United States Minor Outlying Islands
Ellina Chernobilsky, Caldwell College, United States
Nadire Cavus, Near East University, Cyprus
Antonella Carbonaro, University of Bologna, Italy
Berna Aslan, Ankara University, Turkey
Christine J. Briggs, University of Louisiana at Lafayette, United States
Alessandro Benati, The University of Greenwich, Italy
David J. Elliott, New York University, United States
Anne Fernandez, University of Tours, France
Abdullahi Fido, Kuwait University, Kuwait
Murat Tezer, Near East University, Cyprus
Boaz Shulruf, University of Auckland, New Zealand
Begoiza Montero-Fleta, Universidad Politécnica de Valencia, Spain
ASUNCION LOPEZ-VARELA, UNIVERSIDAD COMPLUTENSE MADRID, Spain
David Little, Trinity College, Ireland
Sirin Karadeniz, Bahcesehir University, Turkey
Ozge Hacifazlioglu, Bahcesehir University, Turkey
Aijaz Ahmed Gujjar, Federal College of Education, Pakistan
Christian Guetl, Graz University of Technology, Austria
Crystal Gafford Muhammad, East Carolina University, United States
Huseyin Uzunboylu, Near East University, Cyprus