

Full Length Research Paper

Attitudes of gifted students towards science depending on some variables: A Turkish sample

Metin Orbay^{1*}, Murat Gokdere¹, Hidayet Tereci² and Murat Aydin²

¹School of Education, University of Amasya, 05189 Amasya-Turkey.

²Amasya Science and Art Centers, 05100 Amasya-Turkey.

Accepted 15 February, 2010

This research aimed to examine the science attitudes of gifted students attending the science and art centers (SAC) in Turkey depending on variables such as gender of students, their fields of education, classroom level and the education levels of their families. The test of science related attitudes (TOSRA), developed by Fraser (1978), simplified by Chaerul (2002) and translated into Turkish and the validity and reliability of which were studied by Curebal (2004), was used in the research. It was observed that there was no statistical difference between the science attitudes of students and the above-mentioned variables. A general analysis of the obtained results was performed comparatively with the studies at national and international levels. In line with the results, a discussion was made on what could be done particularly regarding the science and technology instruction of students at SACs which were developed as a suitable model for country conditions.

Key words: Gifted students, science education, science attitude.

INTRODUCTION

Having an important place in the society in developed countries, gifted people are at the focal point of developments in many spheres primarily such as political, economic, military and technological fields of their country. Thus, senior administrators, decision-makers in political and economic fields, manipulators of research and development departments and pioneers of innovations by making inventions in these countries are most likely to be gifted people. Therefore, it is important to identify gifted and talented people in society and provide support and services for them and their families in order to encourage these people to reach their full potential.

When the historical process for the realization of the potentials of gifted people is examined, it is observed that the first and most important practice was indisputably the practice of "Enderun School during Ottoman Empire". Completely contrary to the understanding of blood tie

and aristocratic structure having prevailed during that period, the Enderun system was established on a mechanism based on competence, capability and loyalty (Ari, 2004).

Upon the foundation of modern Republic of Turkey, the Turkish education system basically had an understanding that considered the differences of individuals, who continuously required special education and this understanding advocated that they should be educated in line with their interests and talents. Therefore, the Turkish education system was in a search in parallel to this understanding. The events and developments experienced in the process of search as well as the relationships and interactions of events and developments with their periods, with each other and with the following periods remind of the patterns of an Anatolian carpet. These searches mostly had some breaking points depending on many variables such as perspectives of political powers, economic status of the country, the limited resources allocated for education and the high pace of population increase (Akyuz, 2008).

Although there have been some private- and state-supported initiatives with respect to determining and educating the gifted and talented individuals in Turkey, no

*Corresponding author. E-mail: metin.orbay@amasya.edu.tr.

Abbreviation: SAC, Science and art centers; TOSRA, test of science related attitudes.

noteworthy developments took place until the 1990s (Akarsu, 1991). Recently, however, the models applied in different countries have been examined; the applicability of these models in our country has been discussed; large-scale studies on this subject at national and international levels have been examined and a new model has been developed in order to reach a higher number of gifted children considering some basic conditions of Turkey such as the existing economic, social, cultural and educational opportunities (Donmez, 2004). Referred to as science and art centers (SAC), this model realized the selection of students, selection and training of teachers, training of families and structuring of physical space in the five pilot provinces selected. Today there are 43 SACs in total in 39 different provinces and they serve more than five thousand students (MNE, 2008). The stage of identification of the students to be selected to these centers is conducted under the guidance of Directorate General of Special Education Guidance and Consultative Services of Ministry of National Education (MNE) and consists of steps such as nomination by class teachers, basic ability tests and individual evaluation (MNE, 2008). Although today these centers, serving on the basis of "Additional Course Application School", are confronted with many problems primarily such as running mechanism, insufficiency of physical space, selection of teachers and training of families, they have developed with contributions. These contributions have been provided by the administrators of central organization of MNE, the administrators employed at these centers, teachers, the students educated at the centers themselves and their families. Hence, a significant progress has been made in this field (Donmez, 2004).

Considering the fact that natural sciences have an important place in the development of the country and its economic development and considering that, in this context, the gifted students attending the SACs may undertake essential roles particularly in scientific and technological developments to take place in Turkey, it is necessary to make a careful examination of "Science Education" provided at these centers.

Science education constitutes one of the most important parts of the education of intellectual domain. Intellectually gifted students are greatly interested in natural sciences and the studies in the field of science encourage students to become curious and research. It was observed that laboratory, project and computer aided science education particularly supported the desires and determination of talented students towards science courses (Hoover, 1989). Therefore, a project-based modular structure was preferred as an education program at SACs considering the characteristics of both talented students and science courses. According to this preferred program, the activities to be proposed have to be based on project study and the models, which are compatible

with science subjects, have to be preferred in order for the developed activities to become applicable. In this context, when the conditions of our country are taken into consideration, "the three-stage Purdue model", still being applied in the U.S.A., is considered as one of the important models to respond to existing needs for Turkey (Cepni et al., 2002; Unlu, 2008).

The cognitive development and affective behaviors targeted in education systems are mostly related to the positive or negative tendencies of students towards the related subjects, individuals, events or ideas or stated briefly, related to their attitudes (Tavsancil, 2002). Hence, seeing the extent the targets have been achieved may only be possible through measuring the attitudes believed to be likely to vary in time. Therefore, the importance of measuring attitudes in education is increasing. It should be kept in mind that the curiosity of children attending primary school and their spirit of investigation are particularly at the highest level and that science and technology course ranks at the top of the courses, which deal with the subjects and the questions about which children are curious most. Thus, one of the basic objectives of the instruction performed is to have students at primary education level love natural sciences and to enable the permanent continuation of their desires and curiosities for learning (MNE-UNICEF, 1995). It is a known fact that attitude is of great importance for carrying out significant learning in students regarding science subjects (Abell and Lederman, 2007; Roth, 2009). In connection to this, it is possible to conclude that the increasing attitudes of students will also have a positive effect on their success (Oruc, 1993; Osborne et al., 2003). At this point, studies in the field of science education both contribute to the development of countries and will bring about improvements in the lifestyles of people subjects (Abell and Lederman, 2007; Roth, 2009). Hence, quality in education and instruction should always be given particular importance especially in order to select gifted and talented students and promote their talents and achievement in education.

Questions such as what and how the positive and negative developments in science attitudes of students depend on and how attitude varies by year constitute a basic subject for research. In addition, there are many national (Cakir et al., 2007; Turkmen, 2008) and international (Weinburgh, 1995; Osborne et al., 2003) studies with qualifications of comprehensive literature scanning in this field. The results obtained from the surveys so far and the findings of this study will be comparatively presented in the results and discussion section.

PURPOSE OF THE STUDY

The purpose of the study was to investigate the science attitudes of students in primary education (Level I) and

Table 1a. Distribution of students by education level, gender and field of education.

Education level	Gender		Education field	
	Female f (%)	Male f (%)	Science f (%)	Art f (%)
Primary school (Level I)	15 (46,9)	17 (53,1)	18 (56,3)	14 (43,8)
Elementary school (Level II)	31 (66)	16 (34)	19 (40,4)	28 (59,6)
Total	46 (58,2)	33 (41,8)	37 (46,8)	42 (53,2)

Table 1b. Information on the education level of students' families.

Education level	Mother			Father		
	Level I f (%)	Level II f (%)	Total f (%)	Level I f (%)	Level II f (%)	Total f (%)
Primary school	6 (18.8)	8 (17)	14 (17.7)	1 (3.1)	2 (4.3)	3 (3.8)
Elementary school	7 (21.9)	4 (8.5)	11(13.9)	2 (6.3)	3 (6.4)	5 (6.3)
High school	8 (25)	17 (36.2)	25 (31.6)	6 (18.8)	8 (17)	14 (17.7)
University	11 (34.4)	18 (38.3)	26 (36.7)	23 (71.9)	34 (72.3)	57 (72.2)

elementary education (Level II), who were attending SACs, depending on gender of students, their field of education, classroom level and the education level of their families.

In line with these basic aims, an answer is sought for the following sub-problems. Is there any significant difference between the science attitudes of students at Levels I and II:

- (1) and their gender?
- (2) and their education levels?
- (3) and their fields of education?
- (4) depending on the education level of their families?

METHOD

Context and settings

The population of the study consists of the students at Levels I and II that were educated at SAC at the city center of Amasya in Turkey during 2007 - 2008 academic year. In this universe, some 33 students from Level I and 47 students from Level II, selected through random sample selection, constitute the sample of the research.

The responses of students to the applied attitude scale and to the interview questions during the research reflect their opinions and thoughts. This research is limited to the gifted and talented students attending the SAC at the city center of Amasya in Turkey as of 2007 - 2008 academic year and TOSRA was used for measuring their science attitudes.

Data about the education level, gender and field of education of the students having participated in the research is presented in Table 1 whereas Data about the education level of their families is presented in Table 2. The mean calendar age of the students having participated in the research is 10.3 for Level I and 13.1 for Level II.

Data collection

In order to measure the science attitudes of gifted students,

Likert-type TOSRA, first developed by Fraser (1978) and with a Cronbach alpha reliability coefficient found as $\alpha = 0.78$, was taken as reference Since then. The scale has been applied by many researchers (Khalili, 1987; Stolarchuk and Fisher, 2001; Lowe, 2004; Eccles, 2007).

The short version of the scale, which was reorganized by Chaerul (2002) and divided into 5 subscales, will be used in this study. For its short version, the reliability calculations were found to be at the interval of 0.79 - 0.84 for 5 subscales. The study performed for the reliability of the scale in the context of Turkey was performed by Curebal (2004) and reliability was found at the interval of 0.72 - 0.84 for 5 subscales. A reference was made to specialist views for the validity of the Turkish version and as a result of the views, it was concluded that the measurement instrument was valid (Curebal, 2004).

Gifted students chose one of the alternatives of "strongly agree", "agree", "neither agree nor disagree", "disagree" and "strongly disagree" for the articles given concerning their science attitudes. The scoring of positive attitudes varied from "definitely agree" (5) to "definitely disagree" (1). However, the opposite was carried out while scoring the negative attitudes.

Percentage (%), frequency (f) and mean (\bar{X}) values were calculated for the articles in the measurement instrument and it was intended to find answers to the sub-problems using the required statistical tests depending on the gender of students, their field of education, classroom level and the education level of their families.

RESULTS

The findings obtained from the research are presented according to the sub-problems and briefly interpreted as follows.

Relationship between science attitude and gender

In order to determine whether there was any significant relationship between the science attitudes of students and their gender, non-parametric Mann-Whitney U (MWU) test was used for the total scores obtained from the attitude scale and the results of analysis are given in

Table 2. Description of scales in *TOSRA*.

Scale number and name	Description of scale
1. Career interest in science	Students' future interest in science
2. Leisure interest in science	Students' desire to participate in out-of-school science-related activities.
3. Social implication of science	Students' attitude regarding the positive and negative effects of science society
4. Enjoyment of science lesson	Students' level of enjoyment of classroom science lessons
5. Normality of Scientist	Students' belief about scientist lifestyles

Table 3a. Results of *MWU* test concerning science attitude scores of level I students by gender.

Gender	N	\bar{X}	MWU	U	p
Male	17	18.56	315.50	92.50	0.186
Female	15	14.17	212.50		

Table 3.b. Results of *MWU* Test concerning science attitude scores of level II students by gender.

Gender	N	\bar{X}	MWU	U	P
Male	16	24.34	354.50	237.50	0.813
Female	31	23.34	754.50		

Table 3.

As seen in Table 3, there is no significant difference between the total science attitude scores of students at Levels I and II by gender (For Level I: $U = 92.50$, $p = 0.186 > 0.05$; For Level II: $U = 237.50$, $p > 0.05$).

Relationship between science attitude and education levels

In order to determine whether any significant relationship existed between the attitudes of students and their education levels, a *t*-test for independent groups was performed for total attitude scores and the results of the analysis are given in Table 4.

As seen in Table 4, there is no significant difference between the education levels of students and their total science attitude scores ($t_{77} = -0.077$, $p > 0.05$).

Figure 1 presents the variation of the averages of scores that students obtained from each subscale depending on education levels.

Relationship between science attitude and field of education

In order to determine whether there was any significant relationship between the science attitudes of students and their fields of education at SAC, non-parametric Mann-Whitney U (*MWU*) test was performed for the total scores obtained from the attitude scale and the results of analysis are show in Table 5.

As seen in Table 5, there is no significant difference between the total science attitude scores of students at Levels I and II according to their fields of education (For Level I: $U = 76.50$, $p > 0.05$; For Level II: $U = 232.00$, $p > 0.05$).

Relationship between science attitude and educational level of families

In order to determine whether any significant relationship was present between the science attitudes of students and the education levels of their families, non-parametric Kruskal Wallis H (*KWH*) test was performed for the total scores obtained from the attitude scale and the results of analysis are presented in Table 6.

As seen in Table 6, there is no significant difference between the education levels of guardians of students and total science attitude scores (For Father: $\chi^2 = 5.682$, $p > 0.05$; For Mother: $\chi^2 = 5.986$, $p > 0.05$).

DISCUSSION

In studies that determine the science attitudes of students, there is little agreement about how attitudes vary by gender. Gardner (1975) stressed that gender was one of the most important factors in science attitudes of students. When the surveys until the 1990s were examined, it was observed that the majority of them resulted in favor of (positive) males in the context of the relationship between gender and science attitude (Weinburg, 1995; Robertson, 1987). Nevertheless, when Osborne et al. (2003) examined the recent studies, they concluded that gender had a very slight effect on attitude.

In this research, as clearly seen in Table 3, no significant difference is present between science attitudes of students at Levels I and II that attended SAC at the city center of Amasya in Turkey depending on their gender (For Level I: $U = 92.50$, $p > 0.05$; For Level II: $U = 237.50$, $p > 0.05$). Furthermore, as it is observed in Figure 1, when the scores the students obtained from each subscale depending on gender are examined, it is observed that they are quite close to each other. The results from this

Table 4. Results of *t*-test for independent groups with respect to the education levels of students and their science attitude scores.

Education level	<i>N</i>	\bar{X}	<i>S</i>	<i>sd</i>	<i>t</i>	<i>p</i>
Primary School (Level I)	32	98.69	14.04	77	-0.077	0.689
Elementary School (Level II)	47	98.94	14.14			

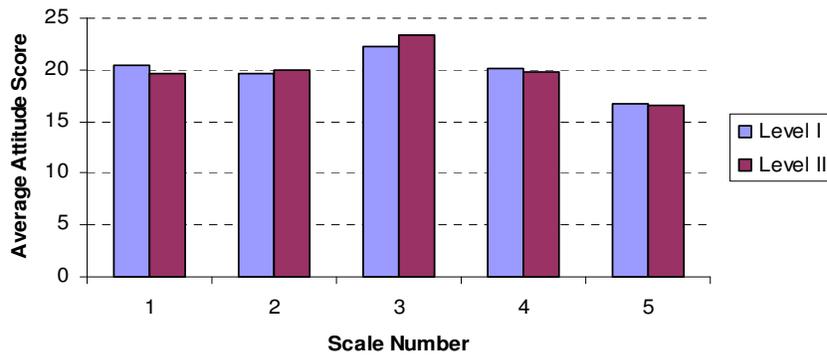


Figure 1. Variation of subscale scores by education levels.

Table 5a. Results of *MWU* test concerning the field of education and science attitude scores of students at level I.

Education field	<i>N</i>	\bar{X}	<i>MWU</i>	<i>U</i>	<i>p</i>
Science	18	19.25	346.50	76.50	0.06
Art	14	12.96	181.50		

Table 5b. Results of *MWU* test concerning the field of education and science attitude scores of students at level II.

Education field	<i>N</i>	\bar{X}	<i>MWU</i>	<i>U</i>	<i>p</i>
Science	19	25.79	490.00	232.00	0.461
Art	28	22.79	638.00		

Table 6a. Results of *KWH* test with respect to father's education level and science attitude scores.

Father's education level	<i>N</i>	\bar{X}	<i>sd</i>	X^2	<i>p</i>
Primary School	3	55.83	3	5.682	0.128
Elementary School	5	24.80			
High School	14	32.57			
University	57	42.32			

results from this study support other studies undertaken with students studying at the primary and secondary levels in Turkey (Gurkan and Gokce, 2000; Curebal, 2004; Cakir et al., 2007).

Table 6b. Results of *KWH* test with respect to mother's education Level and science attitude scores.

Mother's education level	<i>N</i>	\bar{X}	<i>sd</i>	X^2	<i>p</i>
Primary School	14	43.07	3	5.968	0.113
Elementary School	11	30.91			
High School	25	34.44			
University	29	46.76			

When the studies focusing on the relationship between science attitude and education levels in literature are examined, it is observed that the higher the class levels of students, the lower their science attitude scores (Curebal, 2004; Murphy and Beggs, 2003). Even though the students aged 10 - 11 had high self-confidence for science problems, their science attitudes were more negative than those of the students aged 8 - 9 (Murphy and Beggs, 2003). Indeed, studies in a number of countries state that as students' progress through school, their positive attitudes towards science decline (Chaerul, 2002; Lowe, 2004). It was emphasized that insufficiency in programs of science courses, the use of ineffective instruction methods and techniques, the perception of science course as difficult and factors regarding family or social life may be among the basic reasons for this problem (Weinburgh, 1995; Greenfield, 1998; Osborne et al., 2003).

Furthermore, the studies by Gurkan and Gokce (2000), Curebal (2004) and Cakir et al. (2007) in our country concluded that the gains in primary education Level II

and secondary education particularly required an intensive program and caused students to have various difficulties. In parallel to this, it was put forward that students might develop a negative attitude towards natural sciences. Moreover, it has been stressed that the multiple-choice exams (such as OKS [High School Entrance Exam] and OSS [Student Selection Exam]), which focus on academic achievement and ignore individual differences in our country and the process of preparation for these exams might be influential in developing a negative attitude towards science.

In this research, as observed in Table 4, no significant difference is present between students' education levels and total science attitude scores for the relationship between science attitude and education levels ($t_{77} = -0.077$ $p > 0.05$). As observed again in this table, the mean science attitude scores of students at Level II are higher than the attitude scores of students at Level I. The performance of out-of-lesson science experiments and activities and the preference of project-based learning approaches at SACs, established with a basic philosophy, can be considered influential in eliminating the decline in positive attitude with time that widely appears in literature (Abell and Lederman, 2007; Roth, 2009). Moreover, as a result of interviews with the students with a science attitude score below average particularly within students at Level II, the vast majority of students expressed that the process of preparation for OKS and OSS type of multiple-choice exams awaiting them in future periods and particularly the expectations of their families had a negative impact on their science attitudes. In this case, important tasks fall to the administrators, teachers and specialists in guidance working at SACs with respect to family training. At this point, the wide presence of faculties of education in almost all provinces, where SACs are located, can be turned into an advantage, for it is possible for them to receive academic support from faculties of education and to carry out joint project studies. Regarding the problems experienced in the process of the running of these centers (such as training of teachers, training of families, education program and methods) and the works to be done, "the Consultative Committees" indeed included within the legal legislations of SACs should be made up of representatives of MNE and Universities and they should be run actively.

As seen in Table 5, another point appearing in this research is the absence of a significant difference between the total science attitude scores of students at Levels I and II according to their fields of education (For Level I: $U = 76.50$, $p > 0.05$; For Level II: $U = 232.00$, $p > 0.05$). The absence of a significant difference between science attitude scores at both levels for the students educated in the fields of intelligence and talent at SACs may be due to the fact that the first two steps take place in the same way in the process of selection of the

students in both fields. In other words, both groups are nominated by their class teachers and then they are expected to exceed a certain lowest passing score in the basic ability test.

Regarding the education levels, as observed in Table 2, of the mothers of students attending SAC at city center of Amasya in Turkey and participating in this research, 36.7% are University graduates, 31.6% are High School graduates, 13.9% are Elementary School graduates and 17.7% are Primary School graduates while, of their fathers, 72.2% are University graduates, 17.7% are High School graduates, 6.3% are Elementary School graduates and 3.8% are Primary School graduates. Such statistical data remain insufficient in reflecting the education levels of the guardians of students, educated at all primary and elementary school levels at the city center of Amasya in Turkey. Although this seems to be a contradiction, the data from many surveys at international level in fact demonstrate that this does not cause any contradictions. In a research study reporting the socio-economic levels of the families of talented and gifted individuals, who stood out and became famous in the society and accordingly, the education levels of the families, it was detected that of these people, approximately 18% were noble and wealthy, 41% had high education, 31% were businessmen and merchants and the rest were artisans and agricultural workers (Caglar and Ozsoy, 1975). In a similar research, the families of children determined as gifted among the students aged 8 - 13 were found to consist of families with a higher profession (50%) and businessmen and officials (37%) while the remaining families were found to consist of laborer families (Caglar and Ozsoy, 1975). In surveys conducted more recently (Robinson and Olszewski, 1997), it was found that gifted and talented students mostly were from families with moderate and high socio-economic status. In a Turkish study conducted by Daglioglu (2004) concerning the talented-gifted students aged 5 - 6, it was stressed that, of the mothers of students determined, 10% were Primary-Elementary School and High School graduates, 69% were University graduates and 20.7% had a graduate education and likewise, of their fathers, 17.2% were Primary-Elementary School and High School graduates, 62.2% were University graduates and 20.7% had a graduate education.

The fact that today gifted and talented students mostly belong to families with moderate and high socio-economic status might be due to the fact that identification is generally performed at primary and secondary education levels. Thus, "early identification and early education", widely discussed and put into practice in developed countries, should be given more importance particularly focusing on SAC in Turkey (Donmez, 2004).

In contrast to these studies discussed above (Table 6), there is no significant difference between the education

levels of guardians of students and the total science attitude scores (For Father: $X^2 = 5.682$, $p > 0.05$; For Mother: $X^2 = 5.986$, $p > 0.05$). The data obtained in this study support the results obtained by Cakir et al. (2007) and Mordi (1991).

When the mean attitude scores obtained from each subscale are examined, the items where the students scored the lowest were the "Normality of Scientist" and the "Students' belief about scientist lifestyles" ($\bar{X} = 16.61$). In addition, in terms of this scale, the lowest mean attitude score was obtained in a similar research by Curebal (2004) on gifted students. These common negative beliefs may be eliminated through short-term visits by professional scientists, who have become outstanding with their studies particularly in the field of science at SACs, their conversations with students, their active participation in project studies and through the creation of conference media on popular science.

REFERENCES

- Abell SK, Lederman NG (2007). Handbook of Research on Science Education, Routhlege Press, USA.
- Akarsu F (1991). Enderun: The Palace School for the Gifted. European Council for High Ability (ECHA), Netherlands.
- Akyuz Y (2008). History of Turkish Education, Pegema Publishing, Ankara.
- Ari B (2004). Determination of the Talented for High Bureaucracy in the Ottoman State and the Process of Special Training at the Palace, 1st Turkish Congress of Talented Children, Book of Papers, 21-30, Publications of Child Foundation, Istanbul-Turkey.
- Cakir NK, Senler B, Taskin BG (2007). Determination of the Attitudes of Students at Primary Education Level II towards Natural Science Course, J. Turk. Educ. Sci. 5: 637-655.
- Cepni S, Gokdere M, Kucuk M (2002). Development of Sample Activity in the Field of Science on the basis of Purdue Model for Intellectually Gifted Students, Book of Papers for the 5th National Congress of Science and Mathematics Education, Middle East Technical University, Ankara pp. 69-73.
- Chaerul A (2002). A study of student's attitudes physics and classroom environment based on gender and grade level among senior secondary education students in Indonesia. New Mexico State University dissertation UMI. Microfilm 3058579.
- Curebal F (2004). Gifted Students's Attitudes Towards Science And Classroom Environment Based On Gender And Grade Level, Unpublished Graduate Thesis, Ankara: Graduate School of Natural and Applied Sciences at METU.
- Donmez B (2004). Regulations Required in the Establishment and Running of Science and Art Centers, 1st Turkish Congress of Talented Children, Book of Papers, 69-73, Publications of Child Foundation, Istanbul-Turkey.
- Eccles L (2007). Gender Differences in Teacher-Student Interactions, Attitudes and Achievement in Middle School Science, Curtin University, Unpublished Ph.D. Thesis.
- Enc M, Caglar D, Ozsoy Y (1975). Introduction to Special Education, Publications of Ankara University Faculty of Education, Kalite Publishing House, Ankara.
- Fraser BJ (1978). Development of a Test of Science Related Attitudes, Sci. Educ. 62: 509-515.
- Gardner PL (1975). Attitudes to Science, Stud. Sci. Edu. 2: 1-41.
- Greenfield TA (1998). Gender- and Grade-level Differences in Science Interest and Participation, Sci. Educ. 81: 259-276.
- Gurkan T, Gokce E (2000). Attitudes of Primary Education Students towards Natural Science Course. Book of Papers for 4th Congress of Natural Science Education, September 6-8: 188-192.
- Hoover MS (1989). The Purdue Three-stage Enrichment Model as Applied to Elementary Science for the Gifted, Sch. Sci. Math. 89: 244-250.
- Khalili KY (1987). A Cross-cultural Validation of TOSRA, J. Res. Sci. Teach. 24: 127-136.
- Lowe PJ (2004). The Effect of Cooperative Group Work and Assessment on the Attitudes of Students Towards Sciences in New Zeal and Curtin University, Unpublished Doctoral Dissertation.
- MNE (2008). <http://orgm.meb.gov.tr/Kurumlarimiz/OzelEgitimKurumlarimiz/bilim-sanatmrkadres.htm>.
- MNE, UNICEF (1995). "Teacher's Guide for Natural Science Course" Ankara: TISAMAT.
- Mordi C (1991). Factors Associated with Pupil's Attitudes towards Science in Negerian Primary Schools. Res. Sci. Technol. Educ. 1: 39-41.
- Murphy C, Beggs J (2003). Primary Pupils' and Teachers' use of Computers at Home and School. Brit. J. Educ. Technol. 1: 79-83.
- Oruc M (1993). Relationship between Science Attitudes and Science Achievements of Students at Level II at Primary School, Hacettepe University, Institute of Natural and Applied Sciences, Unpublished Graduate Thesis, Ankara.
- Osborne J, Simon S, Collins S (2003). Attitudes Towards Science: a Review of the Literature and its Implications, Int. J. Sci. Educ. 25: 1049-1079.
- Robertson IJ (1987). Girls and Boys and Practical Science. Int. J. Sci. Edu. 9: 505-518.
- Robinson N, Olszewski M (1997). Gifted and Talented Children: Issues for Pediatricians, Pediatr. Rev. 18: 83-90.
- Roth WH (2009). Science Education from People for People, Routledge Press, USA.
- Stolarchuk E, Fisher D (2001). An Investigation of Teacher-Student Interpersonal Behavior in Science Classrooms Using Laptop Computers, J. Educ. Comp. Res. 24: 41-55.
- Tavsancil E (2002). Measurement of Attitudes and Data Analysis with SPSS, Nobel Publication Distribution, Ankara.
- Turkmen L (2008). Attitudes of Candidate Teachers Reaching Senior Grade Level from Freshman Grade Level Educated in the Program of Class Teaching towards Natural Sciences and their Teaching, Kastamonu J. Educ. 15: 91-106.
- Unlu P (2008). An Application of the Three Stage-Purdue Models in Physics Education in Turkey, J. Appl. Sci. 8: 4137-4144.
- Weinburgh MH (1995). Gender Differences in Student Attitudes Toward science: a Meta-analysis of the Literature from 1970 to 1991. J. Res. Sci. Teach. 32: 387-398.