Int J Edu Sci, 28(1-3): 7-14 (2020)
PRINT: ISSN 0975-1122 ONLINE: ISSN 2456-6322
DOI: 10.31901/24566322.2020/28.1-3.1088

Gifted Students' Attitudes towards Science

Ilker Ugulu*

Faculty of Education, Usak University, Usak, Turkey
E-mail: ilkerugulu@gmail.com

KEYWORDS Age. Attitude. Gender. Gifted Students. Grade

ABSTRACT The main objective of this study is to explore the attitudes of gifted students towards science. This study is a descriptive one-shot survey model to determine whether gifted students' attitudes towards science differ according to gender, age and grade variables. The study group of the research consists of 120 gifted students (67 girls, 53 boys). According to the results of the study, it was seen that the attitude scores of the students in 7th grade are slightly higher than the average of the students in 5th and 6th grades. In terms of gender, it was concluded that female students' attitude scores were higher than male students. As a result of the statistical comparison of the attitude scores according to the independent variables of the study, it was concluded that the difference between the averages was not significant in terms of gender, grade level and age variables ($p<0.05$).

INTRODUCTION

The development of science in the last centuries and systematic accumulation of knowledge change the living conditions by means of technology, on the other hand, it changes the way of perception of the world (Erkol and Ugulu 2014; Nadeem et al. 2019). The societies adapting to this change were able to understand the importance of science and position them in their lives and raise their welfare levels (Khan et al. 2018a, b; Ahmad et al. 2019). Therefore, it can be thought that the individuals of the information society of the twenty-first century should be people who can think scientifically (Ugulu and Baslar 2010; Yorek et al. 2016). As a matter of fact, when the related literature is examined; it is seen that attitudes and behaviors of researching, questioning and producing information are considered as the most prominent features of modern society (Ugulu 2015a; Murphy et al. 2019).

In order for science to affect a society in a positive way, first of all, scientific thinking must be spread among the large masses of people and become a part of common thinking (Brauner 2007). At this point, the goal is to create a society that understands science and can make informed decisions (Ugulu and Yorek 2015). Providing scientific thinking skills to individuals of the information society is undoubtedly a duty that educational institutions should undertake (Murphy et al. 2019). For this reason, educating individuals who investigate, question and produce information are considered among the most basic objectives of educational institutions of modern societies (Demirbas and Yagbasan 2006).

Science education is one of the most important parts of the education of intellectual domain (Ugulu 2009; Darling-Hammond et al. 2019). Cognitive development and affective behaviours targeted in educational systems are mostly related to students' positive or negative tendencies towards related subjects, individuals, events or ideas, or they are expressed briefly about their attitudes (Ugulu et al. 2015). In this respect, encouraging positive science attitudes is an important goal in science education because research findings show that attitudes towards science are pioneers of interest in the choice of science and science courses (Azevedo 2018).

Attitudes may change more than the cognitive characteristics of the students (Cannon and Simpson 1985). It has become a common goal for program designers and curriculum developers to influence attitudes towards science, increase students' science achievement, and increase the number of people who will continue their science career in the future (Ugulu et al. 2013). The determination and evaluation of students' current attitudes towards science and various variables affecting these attitudes such as changes in class level, age, gender and socioeconomic status have been the target of many researches for science educators who want to offer appropriate programs or courses to students (Osborne et al. 2003).

Most of the studies investigating attitudes towards science include mainstream students or students with low intellectual or academic skills as a research group (Murphy et al. 2019). There are few studies dealing with the gifted students' attitudes towards science and gifted students in science education (McGinnis and Stefanich 2007). Although it is thought that gifted students with superior cognitive skills can understand science better and thus appreciate science more, there are reasons why these students' attitudes may be less positive than some researchers believe. Intense study programs and pressure, created by more challenging curricula for gifted students, may reduce their interest in science and even other courses (Sak et al. 2015). These students can demonstrate good academic performance and skills while maintaining negative attitudes. Various studies have shown that more intelligent and successful students can develop more negative attitudes towards science, scientific research, and scientists (Disinger and Mayer 1974). In addition, there are studies showing that these students are able to work hard on subjects that they do not like or are not very interested in, and that they can be more successful than other students (Woodrow and Sham 2001). In view of the above, given the fact that attitudes may affect some of the gifted students, studies are needed to determine the true place of gifted students in the continuity of attitudes (Caleon and Subramaniam 2008).

Developing positive attitudes towards science is one of the most important goals of science education (Darling-Hammond et al. 2019). Cross-age research is useful in defining the understanding of a particular concept structured by students at various grade levels (Egalite and Kisida 2017). The meaning of cross-age research is the studies in which different age students are sampled at the same time. Cross-age research provides an opportunity to observe changes in conceptual development as a result of maturation of students and to increase intellectual development (Zeneli et al. 2018). This study includes cross-age examination of the attitudes of gifted students towards science.

Gender is considered as one of the important variables affecting the process of shaping attitudes (Osborne et al. 2003). Many researchers have focused on the needs of gifted girls and boys because of their high potential in science (Harwood and McMahon 1997). However, there are also a few studies on gifted students reporting this subject. The inclusion of gender in this study will contribute to the literature on the attitudes of gifted girls and boys towards science and their active participation in scientific studies. In addition, it is thought that comparing the findings obtained with the results of similar studies which accept gender as an additional variable for analysis would be beneficial for the relevant literature.

Gifted Education in Turkey

Educational models that have gifted education in Turkey can be divided into three groups, including special schools, special classes and after-school programs (Ugulu 2019). Science high schools, conservatories and sports high schools can be given as an example for special schools, Gifted Education Programs, and Science and Art Centers (SACs) can be given as examples for after-school programs. Special classes take place only in private sector schools (Sak et al. 2015).

One of the important problems existing in the education of gifted students in Turkey is the flexibility problem in the national education system. For example, according to the National Education legislation, gifted students can only skip a class in primary school years during their entire education. In addition, the education system does not provide opportunities for gifted students to take courses from universities or upper classes (Sak 2013). Therefore, it is not enough to create new opportunities for gifted students who attend regular classes for their development. For this reason, after-school programs and especially SACs have an important place in the education of gifted students (Ugulu 2015b).

After-school programs are educational programs for gifted students in school or outside school hours, in addition to their school schedule. The SACs, which are run by the Ministry of National Education and widely used throughout the country, the research and education centers on university campuses, and the centers run by the private sector, are the leading after-school programs for gifted students in Turkey (Sak et al. 2015).

Science and Art Centers (SACs)

Science and Art Centers, which are widespread throughout the country, are an after-school program model and started to be established in 1995 to develop their potential by educating primary, secondary and high school gifted students in the time remaining from normal education programs. As of 2019, there are 139 SACs in various provinces and districts (Turkey Ministry of Education 2019). The SAC model aims to provide enriched education at extracurricular hours without separating gifted students from their normal peers. In SACs, students are educated on certain days of the week except for formal education (Karabulut 2010). Students mostly work on social and scientific projects and produce solutions to real-life problems (Orbay et al. 2010).

Objectives

Students with higher scientific backgrounds and literacy levels were found to be more successful in making decisions. In this direction, ensuring active participation of the gifted individuals defined as the most significant human resources of a country in scientific issues is of great importance. The main objective of this study is to explore the attitudes of gifted students towards science. An additional objective of this study was to investigate gender, age and grade level-based differences in gifted students' attitudes toward science.

MATERIAL AND METHODS

Research Design

This study is a descriptive one-shot survey model to determine the attitudes of gifted students towards science and to determine whether these attitudes differ according to gender, age and grade variables.

Sampling

The study group of the research consists of 120 gifted secondary school students (67 girls, 53 boys) studying at Manisa Science and Art Center. The distribution of these students according to their class levels and age groups is presented in Tables 1 and 2.

Table 2: Distribution of students according to grades

	Grade			*Total*
	5th grade	*6th grade*	*7th grade*	
f	45	34	41	120
%	37.5	28.3	34.2	100

Data Collection Tool

In the research, the Science Attitude Inventory (SAI II) developed by Moore and Foy (1997) and adapted to Turkish by Demirbas and Yagbasan (2006) was used. The scale was created by Moore (1973) for the first time, and as a result of the changes over time, the scale, which was determined as 60 items, was reduced to 40 items and necessary arrangements were made. In the scale consisting of 40 items, participants are asked to evaluate themselves on a four-point Likert scale ranging from "1 = I do not agree" to "4 = I agree". In addition, in the personal information form of the test, there are questions about the independent variables such as the names, surnames, genders and grades of the participants.

As a result of the validity and reliability analyses conducted on the scale for this study, it was seen that the items of the scale were collected under a single factor. Demirbas and Yagbasan

Table 1: Distribution of students according to gender and age levels

		10		*11*		*12*		*13*	
		f	*%*	*f*	*%*	*f*	*%*	*f*	*%*
Gender	G	1	100	20	57.1	31	57.4	15	50.0
	B	-	-	15	42.9	23	42.6	15	50.0
Total	1	100	35	100	54	100	30	100.0	

(2006) found that Cronbach's alpha reliability coefficient of the science attitude scale was 0.76 (α=0.76) and Spearman-Brown correlation was 0.84. Considering the results obtained from gifted students in this study, the consistency among the items in the scale was re-examined and the Cronbach alpha reliability coefficient of the scale was determined as 0.86 (α=0.86). In the study of Moore and Foy (1997), Cronbach's alpha reliability coefficient of the science attitude scale was 0.78 (α=0.78) and Spearman-Brown reliability coefficient was 0.80. The values explained about the reliability of the science attitude scale are indicated as appropriate values for determining the students' attitudes towards science (Demirbas and Yagbasan 2006).

Data Analysis

In this study, to determine the attitudes of gifted students towards science, the data obtained from science attitude scale were transferred to the computer and analysed with SPSS 22.00 package program. The t-test and ANOVA test were used to determine whether students' attitudes towards science showed a significant difference in terms of independent variables of the study.

RESULTS

Determining the attitudes of gifted students towards science and the variables that affect these attitudes are important in terms of education to be provided to these students and active participation of students in scientific studies. For this purpose, the average scores obtained by gifted/talented students from the Science Attitude Scale (SAI) and statistical analysis of these scores are presented in tables in this section.

Findings on Students' Attitudes towards Science

The responses of the students in the research group to SAI were evaluated and it was seen that the students reached an average of 114.60 on the scale which was evaluated as 160 points (Table 3). These values range from a minimum of 85 points to a maximum of 139 points.

Table 3: Attitudes of gifted students

Scale	*N*	*Item number*	*Mean (X)*	*Std. dev.*	*Max.*	*Min.*
SAI	120	40	114.60	6.82	139	85

When the attitude scores of gifted students were examined according to their grade levels, the attitude scores of fifth-grade students were 113.84; the attitude scores of the sixth-grade students were determined to be 113.50 and the average scores of the seventh-grade students as 114.11 (Table 4). While the average attitude scores of fifth and sixth-grade students were close to each other, the highest science attitude score was observed at seventh-grade students. In this case, it can be said that there is an increase in the science attitudes of gifted students who receive more science education.

Table 4: Attitude levels according to grades

Grade	*N*	*Mean (X)*	*Std. dev.*	*Max.*	*Min.*
5	45	113.84	8.47	129.00	85.00
6	34	113.50	8.82	139.00	95.00
7	41	116.34	8.37	101.00	134.00
Total	120	114.60	8.56	139.00	85.00

When the attitude scores of the students in the research group were evaluated according to the age variable, it was seen that the average attitude scores of gifted/talented students in different age groups had values close to the general average (X = 114.60) (Table 5). Only one student in the 10-year age group and the only one in the research group was above this average with 122 attitude points. On the other hand, except this 10-year-old student, the attitudes of gifted students towards science increased relatively with increasing age. As in the findings related to the grade level, it can be said that as

Table 5: Attitude levels according to age

Age	*N*	*Mean (X)*	*Std. dev.*	*Max.*	*Min.*
10	1	122.00	-	122.00	122.00
11	35	113.02	9.05	129.00	85.00
12	54	114.88	8.63	139.00	95.00
13	30	115.66	7.91	134.00	102.00
Total	120	114.60	8.56	139.00	85.00

the age of the students increases, their attitudes towards science increase. Also, it was concluded that female students' attitude towards science (X = 115.29) was higher than male students' attitude points (X = 113.71) (Table 6).

Table 6: Attitude levels according to gender

Age	*N*	*Mean (X)*	*Std. deviation*	*Max.*	*Min.*
G	67	115.29	8.99	129.00	85.00
B	53	113.71	7.97	130.00	101.00
Total	120	114.60	856	139.00	85.00

Statistical Comparisons of Attitudes According to Independent Variables

In this section, the findings of whether the differences between science attitude scores of gifted students are statistically significant according to independent variables determined as gender, age and grade are listed.

ANOVA (one-way ANOVA) analysis was conducted to determine whether the attitudes of gifted students showed significant differences according to class and age. It was found that the attitude scores of the students in the study group did not show a statistically significant difference compared to both independent variables ($p < 0.05$). Statistical analysis of the significance of the difference between the attitude scores of students according to class and age variables is presented in Tables 7 and 8.

Table 7: ANOVA analysis of attitude scores according to grades

	Sum squares	*dF*	*Mean square*	*F*	*P*
Between groups	191.169	2	95.585	1.310	0.274
Within groups	8535.631	117	72.954		
Total	8726.800	119			

In order to determine whether students' attitudes towards science showed a significant difference according to gender, independent sample t-test analysis was performed. The results of the analysis showed that the difference between the attitude scores of the students was not statistically significant ($p < 0.05$) (Table 9).

Table 8: ANOVA analysis of attitude scores according to ages

	Sum squares	*dF*	*Mean square*	*F*	*P*
Between groups	179.829	3	59.943	0.814	0.489
Within groups	8546.971	116	73.681		
Total	8726.800	119			

Table 9: t-test analysis of attitude scores according to gender

Gender	*N*	*Mean (X)*	*Std. dev.*	*F*	*dF*	*p*
G	67	115.29	8.99	0.00	118	0.317
B	53	113.71	7.97			

DISCUSSION

The aim of the study was to determine the attitudes of gifted students who are thought to make important contributions to scientific studies and to compare these attitudes according to variables such as education level, gender, and age. According to the results of the study, when the average attitude towards the environment is evaluated according to the class levels of the students, it was seen that the attitude scores of the students in 7th grade are slightly higher than the average of the students in 5th and 6th grades. In terms of gender, it was concluded that female students' attitude scores were higher than male students. As a result of the statistical comparison of the attitude scores of the gifted students according to the independent variables of the study, it was concluded that the difference between the averages was not significant in terms of gender, grade level and age variables ($p < 0.05$).

Many important studies in science education approached experimental research performed with students from a cross-age perspective (Egalite and Kisida 2017). The results of all studies showed that although the concepts of children's scientific phenomena changed over time, some alternative concepts lasted from preschool to college (Westbrook and Marek 1991). In the present study, it was determined that high-grade

students had more positive attitudes toward science than low-grade students. Numerous studies performed with the mainstream students support the findings that students start science studies with positive attitudes, but the situation is rapidly decreasing by secondary and high school (Farenga and Joyce 1998). Similar to this, Swiatek and Lupkowski-Shoplik (2000) stated that negative attitudes towards science increase from third through sixth grade. The fact that gifted students have to live their lives under the gifted label, their rivalry with their peers, and their constant exposure to challenging tasks called gifted education can suppress their attitudes towards science (Sak et al. 2015). While competition and difficulty are a feature of a gifted education curriculum, talented students may lose motivation if the quality and level of competition and educational environment are not appropriate. However, Freedman (1997) stated that laboratory education positively affects students' attitudes towards science courses. But, the number of laboratory experiments is falling at high levels because the experiments are becoming more complex and teachers do not prefer to conduct experiments. However, related to the findings about the attitudes of gifted students determined in the present study, it can be said that the students' attitudes towards science increase with the science education they received, considering that the motivation of gifted students towards science was more than other students.

Studies conducted in some countries indicate that students' positive attitudes towards science decrease as they progress in school (Egalite and Kisida 2017). It is thought that the inadequacies in the school environment and the curriculum of science courses, the use of ineffective teaching methods and techniques in the teaching processes, the perception of difficulty for science courses, and the factors related to family or social life may be among the main causes of this problem. In Turkey, Curebal (2004) stated that students' grade level increased science attitude scores fall. According to the studies performed by Orbay et al. (2010) and Cakir et al. (2007) in Turkey, the gains in primary education and secondary education curricula required an intensive program and caused students to have various difficulties. In parallel, it has been suggested that students can develop a negative attitude towards science.

The existence of gender-based differences in achievement and participation in science and its attitude towards science are widely accepted (Caleon and Subramaniam 2008). When the studies conducted up to the 1990s were examined, it was found that the majority of them resulted in favour of men in terms of the relationship between gender and science attitudes (Orbay et al. 2010). However, recent research showed that gender had a slight effect on attitudes towards science (Darling-Hammond et al. 2019). In this study, there is no significant difference between male and female students' attitudes towards science. Despite the evidence that gender differences exist in attitudes toward science, the process of how these attitudes affect science outcomes is unclear (Caleon and Subramaniam 2008).

In this study, although there was no statistically significant difference between them, the attitudes of female students towards science were found to be higher than male students. In mathematics and science, less research has been done about gifted men than gifted women. The reason for this situation is that men pursue more careers in these areas than women (Curebal 2004). There are various reasons in the literature to explain why some talented women do not show interest in science, do not succeed in science or do not continue scientific studies. Lack of talent or effort, self-efficacy in mathematics, science and technology, inadequacy in the school environment and curriculum, the impact of standardized tests, attitudes of parents and teachers on performance, and future career plans are among the factors affecting women's attitudes towards science (Reis and Park 2001). On the other hand, the main reason why there is not a serious gender difference between the attitudes in this study can be assumed that the applied scale aims to evaluate the attitudes towards general science, not only to science branches such as physics, chemistry and life sciences. For example, Lee and Burkam (1998) showed that gender differences in attitudes towards physical sciences were a more distinctive factor than biological sciences. Furthermore, when these students are gifted students, it is normal for them to show higher motivation and more positive attitudes towards science in general.

CONCLUSION

Science has become increasingly important and evident in all areas of life, for all countries, and especially for people living in a developing country. It seems essential and critical to investigate gifted students' attitudes towards science. In this study, as a result of quantitative analysis, some important findings related to the research questions were discovered. Although not statistically significant, it was found that higher grade students had more positive attitudes towards science classes than lower grade students. Also, there is no significant difference between the attitudes of male and female students towards science. However, it is widely accepted that gender-based differences are one of the factors affecting science participation and attitudes towards science. Further studies are needed to identify the educational needs of gifted students and to improve learning environments and, most importantly, to identify all factors affecting these processes.

RECOMMENDATIONS

The results of the study support the results of similar studies in the past and showed that students have different attitudes towards science at different grade levels. Educators should make educational applications for the development of the attitudes of gifted students in the educational processes. Since boys and girls perceive themselves differently and have different expectations from the educational environment, the teacher should provide activities that help to meet specific gender needs. The educator should choose the different classroom environment for the students at different grade levels, and the teacher should provide activities to meet the specific needs.

LIMITATIONS

This study is limited in many ways. First, this analysis does not include measurements of factors other than class level, gender, and age. On the other hand, the effects of the educational background of students and parents were excluded. Many educators believe that these factors can interact with influencing students' learning outcomes. The sample size is another limiting factor, the larger sample size provides a better opportunity to see attitudes towards both the science and classroom setting.

REFERENCES

Ahmad K, Wajid K, Khan ZI, Ugulu I, Memoona H, Sana M, Nawaz K, Malik IS, Bashir H, Sher M 2019. Evaluation of potential toxic metals accumulation in wheat irrigated with wastewater. *Bull Environ Contam Toxicol*, 102: 822–828.

Azevedo FS 2018. An inquiry into the structure of situational interests. *Sci Educ*, 102(1): 108–127.

Brauner A, Carey J, Henriksson M, Sunnerhagen M, Ehrenborg E 2007. Open-ended assignments and student responsibility. *Biochem Mol Biol Educ*, 35(3): 187-192.

Cakir M, Mungan I, Karakas T, Girisken I, Okten A 2007. Menstrual pattern and common menstrual disorders among University students in Turkey. *Pediatric Int*, 49: 938-942.

Caleon IS, Subramaniam R 2008. Attitudes towards science of intellectually gifted and mainstream upper primary students in Singapore. *J Res Sci Teach*, 45(8): 940–954.

Cannon RK, Simpson R 1985. Relationships among attitude, motivation, and achievement of ability grouped, seventh grade, life science students. *Sci Educ*, 69: 121–138.

Curebal F 2004. *Gifted Students' Attitudes Towards Science and Classroom Environment Based on Gender and Grade Level*. Graduate Thesis, Unpublished. Ankara: Graduate School of Natural and Applied Sciences at METU.

Darling-Hammond L, Flook L, Cook-Harvey C, Barron B, Osher D 2019. Implications for educational practice of the science of learning and development. *Appl Develop Sci*, http://dx.doi.org/10.1080/10888691.2018.1537791

Demirbas M, Yagbasan R 2005. The functional importance of scientific attitudes in science teaching and adaptation of scientific attitude scale into Turkish. *Uludag University Educational Faculty Journal*, 18(2): 363-382.

Disinger JF, Mayer J 1974. Student development in junior high school science. *J Res Sci Teach*, 11: 149–155.

Egalite AJ, Kisida B 2017. The effects of teacher match on students' academic perceptions and attitudes. *Educ Eval Pol Anal*, 40(1): 59—81.

Erkol S, Ugulu I 2014. Examining biology teacher candidates' scientific process skill levels and comparing these levels in terms of various variables. *Proc Soc Behav Sci*, 116: 4742-4747. http://dx.doi.org/10.1016/j.sbspro.2014.01.1019

Farenga SJ, Joyce BA 1998. Science-related attitudes and science course selection: A study of high-ability boys and girls. *Roeper Rev*, 20: 247-251.

Freedman MP 1997. Relationship among laboratory instruction, attitude toward science, and achievement in science knowledge. *J Res Sci Teach*, 34: 343-357.

Harwood WS, McMahon MM 1997. Effects of integrated video media on student achievement and attitudes in high school chemistry. *J Res Sci Teach*, 34: 617-631.

Karabulut R 2010. *The History of Education of Gifted and Talented Students in Turkey.* Master's Thesis, Unpublished. Turkey: University of Abant Izzet Baysal.
Khan ZI, Ugulu I, Sahira S, Ahmad K, Ashfaq A, Mehmood N, Dogan Y 2018a. Determination of toxic metals in fruits of Abelmoschus esculentus grown in contaminated soils with different irrigation sources by spectroscopic method. *Int J Environ Res,* 12: 503-511. https://doi.org/10.1007/s41742-018-0110-2
Khan ZI, Ugulu I, Umar S, Ahmad K, Mehmood N, Ashfaq A, Bashir H, Sohail M 2018b. Potential toxic metal accumulation in soil, forage and blood plasma of buffaloes sampled from Jhang, Pakistan. *Bull Environ Contam Toxicol,* 101: 235-242. https://doi.org/10.1007/s00128-018-2353-1
Lee VE, Burkam DT 1998. Gender differences in the middle grade science achievement: Subject domain, ability level, and course emphasis. *Sci Educ,* 80: 613-650.
McGinnis JR, Stefanich G 2007. Special needs and talents in science learning. In: SK Abell, NG Lederman (Eds.): *The Handbook of Research in Science Education*. Mahwah, New Jersey: Lawrence Erlbaum Press, pp. 287–318.
Moore R 1973. The development field test and validation of scales to assess teachers' attitudes toward teaching elementary school science. *Sci Educ,* 57: 271-278.
Moore WR, Foy R 1997. The Scientific Attitude Inventory: A Revision (SAI II). *J Res Sci Teach,* 34(4): 327-336.
Murphy C, Smith G, Broderick N 2019. A starting point: Provide children opportunities to engage with scientific ýnquiry and nature of science. *Res Sci Educ,* https://doi.org/10.1007/s11165-019-9825-0
Nadeem M, Qureshi TM, Ugulu I, Riaz MN, An QU, Khan ZI, Ahmad K, Ashfaq A, Bashir H, Dogan Y 2019. Mineral, vitamin and phenolic contents and sugar profiles of some prominent date palm (*Phoenix dactylifera*) varieties of Pakistan. *Pak J Bot,* 51(1): 171-178. http://dx.doi.org/10.30848/PJB2019-1(14)
Orbay M, Gokdere M, Tereci H, Aydin M 2010. Attitudes of gifted students towards science depending on some variables: A Turkish sample. *Sci Res Essays,* 5(7): 693-699.
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.
Reis SM, Park S 2001. Gender differences in high-achieving students in math and science. *J Educ Gifted,* 25: 52-73.
Sak U 2013. Education programs for talented students model (EPTS) and its effectiveness on gifted students' mathematical creativity. *Educ Sci,* 38: 51-61.
Sak U, Ayas MB, Sezerel BB, Opengin E, Ozdemir NN, Gurbuz SD 2015. Gifted and talented education in Turkey: Critics and prospects. *Turkish J Giftedness Educ,* 5(2): 110-132.
Swiatek MA, Lupkowski-Shoplik A 2000. Gender differences in academic attitudes among gifted elementary school students. *J Educ Gifted,* 23: 360-377.
Turkey Ministry of Education 2019. Ministry of Education Statue. From <http://www.meb.gov.tr/mevzuat> (Retrieved on 10 June 2019).
Ugulu I 2009. Determination of retention of students' knowledge and the effect of conceptual understanding. *Biotech Biotechnol Equip,* 23(1): 14-18.
Ugulu I, Baslar S 2010. The determination and fidelity level of medicinal plants used to make traditional Turkish salves. *J Altern Compl Med,* 16(3): 313-322. http://doi.org/10.1089=acm.2009.0040
Ugulu I, Sahin M, Baslar S 2013. High school students' environmental attitude: scale development and validation. *Int J Edu Sci,* 5(4): 415-424.
Ugulu I 2015a. Development and validation of an instrument for assessing attitudes of high school students about recycling. *Environ Educ Res,* 21(6): 916-942. http://doi.org/10.1080/13504622.2014.923381
Ugulu I 2015b. A quantitative investigation on recycling attitudes of gifted/talented students. *Biotech Biotechnol Equip,* 29: 20-26. http://doi.org/10.1080/13102818.2015.1047168
Ugulu I, Yorek N 2015. Pre-Service teachers' comments toward official teacher selection system (Civil Servant Selection Examination, KPSS) in Turkey: A qualitative analysis. *Open J Soc Sci,* 3: 182-189. http://dx.doi.org/10.4236/jss.2015.39025
Ugulu I, Yorek N, Baslar S 2015. The effect of recycling education on high school students' conceptual understanding about ecology: A study on matter cycle. *Educ Res Rev,* 10(16): 2207-2215. http://dx.doi.org/10.5897/ERR2015.2386
Ugulu I 2019. Efficacy of recycling education integrated with ecology course prepared within the context of enrichment among gifted students. *Int J Edu Sci,* 26(1-3): 49-58. https://doi.org/10.31901/24566322.2019/26.1-3.1086
Westbrook SL, Marek EA 1991. A cross-age study of student understanding of the concept of diffusion. *J Res Sci Teach,* 28: 649-660.
Yorek N, Sahin M, Ugulu I 2010. Students' representations of the cell concept from 6 to 11 grades: Persistence of the "fried-egg model". *Int J Physic Sci,* 5(1): 15-24.
Yorek N, Ugulu I, Aydin H 2016. Using self-organizing neural network map combined with ward's clustering algorithm for visualization of students' cognitive structural models about aliveness concept. *Computational Intelligence and Neuroscience,* Article ID 2476256, 1-14. http://dx.doi.org/10.1155/2016/2476256
Zeneli M, Tymms P, Bolden D 2018. Interdependent cross-age peer tutoring in mathematics. *Int J Psych Educ Stud,* 5(3): 33-50.

Paper received for publication in October, 2019
Paper accepted for publication in January 2020

Table 6: Attitude levels according to gender

Age	*N*	*Mean (X)*	*Std . deviation*	*Max.*	*Min.*
G	67	115.29	8.99	129.00	85.00
B	53	113.71	7.97	130.00	101.00
Total	120	114.60	856	139.00	85.00