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Research Article

Investigation of Gifted Students' Problem-Solving Skills[1]

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Abstract

The aim of this study is to examine the level gifted students' problem-solving skills in terms of their gender and grade level. A total of 68 fourth, fifth, sixth, and seventh grade gifted students enrolled in a Science and Art Center participated to the study. In this quantitative survey study, Problem-solving Inventory for Children developed by Serin, Bulut Serin, and Saygılı (2010) was used to collect data from the participants. This instrument consists of three dimensions, which are namely confidence to problem-solving skills, self-control, and avoidance. In order to determine the level of problem-solving skills, an independent-sample t-test and one-way ANOVA were utilized. The results indicated that the level of gifted students' problem-solving skills was not high. Moreover, while gender did not play role in their problem-solving skills, some grade levels of the participants were significantly superior to other levels regarding to problem-solving skills. In general, it was seen that problem-solving skills of gifted students gets lower as their grade level increases. Based on the findings, some implications were recommended.

Keywords

gifted students, problem-solving skills

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Introduction

Among target groups of teaching, gifted students take an important place since gifted students already have extra motivation and talent to learn and perform in classes, and they can also think and learn topics more rapidly than their peers. Therefore, it is necessary to facilitate their educational development. In general, gifted children can be described as possessing and acting better performance and skills at tasks as compared to other children (Ataman, 1998). Therefore, when gifted students compared to normal students, it is seen that they have some different characteristics when they learn. Winebrenner (2000) described several differences in learning of gifted students as compared to their classmates:

- *"They learn new material in much less time.*
- *They tend to remember that spiral curriculums and reviewing previously mastered concepts a painful experience.*
- *They perceive ideas and concepts at more abstract and complex levels than do their peers.*
- *They become passionately interested in specific topics and have difficulty moving on to other learning tasks until they feel satisfied that they have learned as much as they possibly can about their passionate interest.*
- *They are able to operate on many levels of concentration simultaneously, so they can monitor classroom activities without paying direct or visual attention to them." (*p. 54).

Another typical characteristic that distinguish gifted students from their peers is their problem-solving skills (Enç, 2005). As Schiever and Maker (2003) reported that giftedness and effective problem-solving skills are positively related to each other. The possible reason of this is believed to be differences of individuals' intelligence (Stankov & Roberts, 1997).

In terms of education of gifted students, Cutts and Moseley (2001) urged that these students' development may be unfavorable for them if their education without caring or by leaving up to chance. Therefore, rather than the probability of losing these gifted individuals, their learning environments and conditions should be well-prepared (Çapan, 2010). For this reason, researchers have recently argued how gifted children' education can be effective when considered gifted students' high capabilities (Hedricks, 2009; Yoon, 2009). There are a lot of models, strategies and suggestions in the literature related to gifted students' education. Based on the research in the related literature, teaching strategies that support problem-solving skills, critical and creative thinking skills, and enhancing achievement are the key points of the education of gifted students (Johnsen & Ryser, 1996). This point is important especially in planning the teaching program and instruction for gifted students (Davis & Rimm, 1998). In accordance with the purpose, gifted students' problem-solving skills were focused in this paper.

The definitions of problem-solving and related terms vary in the literature. For instance, Bingham (1958) describes problem-solving process as efforts to overcome obstacles to achieve a specific aim. Moreover, Wilson (2000) defined problem-solving as a process that is maintained by student to reach a solution by using thinking, reasoning, and carrying out the plan during this process. Similarly, Heppner and Krauskopf (1987) described problem-solving as a process to find out ways to overcome difficulties during achieving the goal. According to Toluk and Olkun (2001), problem-solving skills refers to the situations or conditions where individuals solve their problems they come across by using their own knowledge or experiences. Individuals utilize their creativity, imagination and obtained knowledge during this process (Çakıroğlu, Sarı, & Akkan, 2011). Also, in problem-solving process, there is not only way to achieve a solution. Yet, Bingham (1958) stated that there are some common points in problem-solving. These are (1) identification of problem, (2) clarification of problem, (3) collection of data, (4) selection and organization of data, (5) determination of possible solutions, and (6) evaluation of solutions. According to Taylan (1990), when an individual realizes that he or she should react to a target set, the problem-solving process is started. In other words, when the individual has a target, he makes an effort to achieve it. How an individual perceive himself during problem-solving, the level of self-confidence, the way of focusing on problem, the capability of generating solutions and decision-making affect the process of handling problem. In this context, problem conditions may require different reactions or performances in terms of the dimensions which these conditions include. Even the behaviors which are needed by problem-solving processes vary from problem to problem or individual to individual, problem-solving processes have some certain general and basic phases.

According to Heppner and Baker (1997), problem-solving skills include three dimensions. First dimension is "confidence in problem-solving skills", which refers to personal confidence of individuals when they start to solve a problem, and personal beliefs to their problem-solving abilities. In other words, the items in this dimension reflect individuals' self-confidence and persistence against problems. Second, the "self-control" dimension comprises self-managing against problems, more autonomous behaviors and ideas, and controlling emotional responses and behaviors against problems. In the third dimension called "avoidance", individuals prefer delaying, ignoring, or avoiding the real problem instead of facing and solving it.

Heppner's three dimensions are consistent with earlier research. For instance, Rotter (1978) claimed that individual's affection and reflection against a problem plays important role during problem-solving. This seems close to Heppner's confidence dimension and control dimension. Also, Lefcourt and Loughlin (1966)

stated that having confidence on the ability of controlling the environment is linked with being a good problem-solver.

In the light of these dimensions, Saygılı (2014) examined problem approaches of gifted students, and failed to find statistically significant difference between the level of problem-solving skills as well as its subscales for gender. Similarly, there was no significant difference between grade level and problem-solving skills. Moreover, both gifted and non-gifted students had similar level of problem-solving skills with regards to self-confidence, self-control, and avoidance. Therefore, she concluded that children' problem-solving skills are not only contingent both it related to how gifted they are.

Although it is likely to expect great performance from gifted students in classes in terms of problem-solving skills and other academic skills as compared to regular students, they may fail if they cannot get a proper teaching strategy, thus their potential remains silent (Rotigel & Fello, 2004). Therefore, gifted children have potential to develop their performance if their educational opportunities are enhanced in accordance with their special needs (Akarsu, 2004). However, it is known that standard curriculums do not present convenient strategies to gifted students (Rotigel & Fello, 2004). Traditional methods are not fit for gifted students due to multiple summarizations and unable of the deep learning of the topics (Johnson, Boyce & VanTassel-Baska, 1995). In similar, Kanlı and Emir (2009) stated that when the information related to gifted students' experiences in schools is examined, it is obvious to see that they do not receive appropriate education as they supposed to have. It is recommended that high-ability students should take a stronger and different curriculum that is qualitatively better (Davis & Rimm, 1998; VanTassel-Baska, 1994). To do this, they should get different learning methods and strategies to display their great potentials easily in their society (Freeman, 1999; Renzulli, 1998). Similarly, VanTassel-Baska (1994) explained several reasons to understand why gifted students need differentiate curriculum as follows: (1) Gifted learners require a special education program due to their learning needs. (2) Gifted learners usually fail to develop their potential and nourish their capabilities evenly. (3) Ordinary school programs fail to meet gifted learners' needs. (4) The rate of change in school and innovative efforts remain slow for gifted learners as compared to the rest.

Regarding to Turkish national education context, since Turkish education system has a centralized management, almost all teachers follow the same textbook and national science curriculum implemented countrywide in Turkey. Although the curriculum is student-centered, the implemented curriculum is different from the written curriculum (Genç & Küçük, 2003; Yangın & Dindar, 2007). Teachers tend to use the suggested activities to justify the given content rather than encouraging students' contribution to learning process (Kozandağı, 2001; Gökçe, 2006; Özmen,

2003). In addition, textbooks may result gifted learners' in getting bored since they are not compatible with their outstanding level of learn and perform. They may also dislike classical presentations. Rather, they want to challenge, to express their own ideas, and to have opportunities to study deeply on a project or problem that is related to their own interest. Therefore, it is thought that their skills may remain under pressure due to some problems in their education.

To sum up, gifted students own higher potential to achieve topics and abilities as compared to normal students. Due to this potential, it is expected that their problem-solving skills, creative and analytical thinking skills are also at high levels. However, it is possible that these skills may remain silent unless developing or promoting them. In this respect, this study intends to give an idea to see the current situation of gifted students' problem-solving skills. With the determining of problem-solving skills of gifted students, it can be possible to understand and recognize them closer; and to make further research related to this issue. Besides, determining the situation may provide the researchers to make some suggestions to curriculum developers in terms of considering the gifted students' needs while developing curriculum and textbooks; and teachers in terms of learning about the promoting ways of gifted students' problem-solving skills; and teacher educators to teach the ways of promoting problem-solving skills of gifted students. In the light of aforementioned reasons, the purpose of this research is to examine the level of problem-solving skills of gifted students as well as the role of gender and grade level on it. Based on this main problem of the study, following research questions will be investigated in this study:

- What is the level of gifted students' problem-solving skills?
- Do gifted students' level of problem-solving skills differ according to their gender?
- Do gifted students' level of problem-solving skills differ according to their grade level?

Method

Research Design

This study is a quantitative research since quantitative data was used in order to address the study's aims and to handle the information obtained from the sample. The data collection was accomplished by self-reports of participants through the scale used in the study. Also, this study was designed as one-time cross-sectional survey research. In one-time cross-sectional survey studies, information for study is collected at one point in time from a sample of predetermined population (Fraenkel & Wallen, 2006).

Participants

The study was conducted during 2015-2016 school year's spring semester. The sample was consisted of 68 middle school gifted students enrolled at a Science and Art Center in Turkey. The sample of this study was generated through convenience

sampling method from the accessible population. Of 68 participants, 24 (35.3 %) were male while the remaining 44 of participants were female (64.7 %). Their age was ranged from 9 to 14 (X= 11.47, SD= 1.50). Moreover, participants' grade levels were distributed nearly equally (see Table 1).

Table 1.

Frequency and Percentages in terms of Gender and Grade Level

Variables		Frequency (f)	Percentage (%)
Gender	Male	24	35.3
	Female	44	64.7
	Missing	-	-
Grade Level	4th	19	27.9
	5th	18	26.5
	6th	15	22.1
	7th	16	23.5
	Missing	-	-
Total		68	100.0

Data Collection Instruments

The data was collected using Problem-solving Inventory for Children (PSIC). The PSIC which was developed by Serin, Bulut Serin, and Saygılı (2010) was used to determine the self-perception levels of gifted students' problem-solving skills. It was developed to measure problem-solving skills and behaviors of primary school pupils and their perceptions related to problem-solving. It is a 24-itemed and 5-point Likert-type scale measurement tool including three subscales which are namely, "Confidence to Problem-solving Skills" (12 items), "Self-control" (7 items) and "Avoidance" (5 items). In calculation of PSIC scores, self-control and avoidance were coded reversely. Getting high scores refers to high proficiency of the participant in problem-solving. Cronbach alpha reliability coefficient calculated as .80 for whole instrument by Serin, Bulut Serin, and Saygılı (2010). In the present study, it was found as .88. The Cronbach alpha coefficient values for subscales are presented in Table 2.

Table 2.

Subscale Reliability Coefficients of PSIC

Subscale	Number of Items	Cronbach alphas (Serin, Bulut Serin, & Saygılı, 2010)	Cronbach alphas (Present Study)
Confidence	12	.85	.70
Self-control	7	.78	.85
Avoidance	5	.66	.79
Total	24	.80	.88

Data Analysis

In this study, descriptive statistics was used to determine the level of problem-solving skills of gifted students. Moreover, an independent-sample t-test was run to test whether mean score of problem-solving skills differ according to participants' gender. In addition, One-way ANOVA was used to analyze participants' scores differ from each other in terms of their grade level. The assumptions of these statistical tests were conducted and verified before running the tests.

Results and Discussion

The descriptive statistics related to gifted students' problem-solving skills in terms of self-confidence, self-control and avoidance was given. In this part, mean scores, standard deviations, skewness and kurtosis values of these variables were presented as descriptive statistics in Table 3.

As depicted in the Table 3, the mean scores for each subscale of problem-solving skills was all above the midpoint of the 5-point Likert scale. However, these values were not very high. These findings suggested that gifted students have problem-solving skills at moderate level in general (*M*= 3.75, *SD*= .67). More specifically, they appeared to feel confident in problem-solving (*M*= 3.87, *SD*= .75). In addition, students had moderately autonomous behaviors and ideas, and controlled their emotional responses and behaviors against problems (*M*= 3.49, *SD*= .96). Besides, they appeared to prefer not to delay, ignore, or avoid the problem instead solving it (*M*= 3.85, *SD*= .93).

Table 3.

Descriptive Statistics of Gifted Students toward Problem-solving Skills

	M	*SD*	*Skewness*	*Kurtosis*
Confidence	3.87	.75	-.91	.88
Self-control	3.49	.96	-.28	-.94
Avoidance	3.85	.93	-.65	-.16
Total Problem-solving Skills	3.75	.67	-.23	-.73

Based on the findings of descriptive statistics, it can be seen that gifted students' problem-solving skills are somewhat favorable. As depicted above, the highest mean score was found in the confidence dimension. This result indicated that students' personal beliefs regarding to their problem-solving abilities were relatively higher. The second highest mean score is on avoidance subscale. This implies that gifted students make effort to solve the problem rather than avoiding from taking

responsibilities to solve the problem or facing with the problem. Although the mean score of the self-control dimension was found lowest as compared to others, it is still above the mid-point of five-point scale. This finding indicated that gifted students have self-managing skills against problems, and therefore they can control their emotional responses when they are facing with a problem. Nevertheless, these results showed that although they believe they can handle the problem by making effort and taking responsibilities, they have less belief in controlling their emotions and demonstrating autonomous behaviors. In the related literature, it was seen that some research indicated that one of the typical characteristics of gifted students is their problem-solving skills (Enç, 2005), and giftedness and effective problem-solving skills are positively related to each other (Schiever & Maker, 2003). Yet, some of them found non-significant differences between gifted and non-gifted students' problem-solving skills in terms of confidence, self-control, avoidance, and total problem-solving skills.

There was no comparison between problem-solving skills of gifted students and normal students in this study, but it would be expected that level of problem-solving skills of gifted students would be high due to their high potential. However, results showed that although those skills were not so low, nor they were not so high as much as expected. The possible reason of this situation could be some problems in education system in Turkey as mentioned in the introduction part. Therefore, it is possible to say that these students' skills may remain silent since they could not take education that satisfies their needs.

In addition, independent-samples t-test was conducted to compare the scores of gifted students' problem-solving skills in terms of confidence, self-control, and avoidance for males and females. Before the t-test was run, missing value check and Levene's test for equality of variances were done. There were no missing values in the related variables. Also, Levene's test significance value was found higher than .05. As it can be seen from the Table 4, all mean scores of males and females in each subscale were close to each other. In addition, there was no significant difference in confidence scores for males (M = 3.83, SD = .61) and females (M = 3.89, SD = .81; t (66) = .324, p = .75, two-tailed). Similarly, there was no significant difference in self-control scores for males (M = 3.49, SD = .99) and females (M = 3.49, SD = .96; t (66) = -.006, p = .99, two-tailed). Likewise, there was no significant difference in avoidance scores for males (M = 3.85, SD = .93) and females (M = 3.85, SD = .93; t (66) = -.019, p = .99, two-tailed). All in all, there was no significant difference in total scores of gifted students' problem-solving skills for males (M = 3.73, SD = .67) and females (M = 3.76, SD = .68; t (66) = .3172, p = .86, two-tailed).

Table 4.
The t-Test Results on Problem-solving Scale Scores according to Gender

	Gender	*M*	*SD*	*t*	*p*
Confidence	Male	3.83	.61	.324	.75
	Female	3.89	.81		
Self-control	Male	3.49	.99	-.006	.99
	Female	3.49	.96		
Avoidance	Male	3.85	.93	-.019	.99
	Female	3.85	.93		
Total Problem-solving Skills	Male	3.73	.67	.172	.86
	Female	3.76	.68		

When findings of the study corresponding to gender examined, it is obvious to say that there was no statistical difference of male and female gifted students' problem-solving skills scores. Even though scores were found slightly in favor of female gifted students in confidence dimension and total problem-solving skills, this result cannot be considered as an important superiority. When glancing to the previous studies results, many of them were failed to find a difference of problem-solving skills according to gender in primary education level (Terzi Işık, 2000; Şahin, 2000), high school level (Saygılı, 2000), and college level (Basmacı, 1998; Çam, 1997, Taylan, 1990). However, few studies reported that female performed better at problem-solving skills than males (Katkat, 2001; Ülger, 2003). From here, it can be concluded that the present study supported to majority of the earlier studies' findings, suggesting that being male or female does not relate with the level of problem-solving skills.

To investigate whether gifted students' level of problem-solving skills differ from each other based on their grade level, One-way ANOVA test was conducted. Before running this test, Levene's test value was checked, and subsequently obtained a non-significant value, suggesting that the homogeneity of variances did not violated. Afterwards, a one-way between-groups analysis of variance was conducted to explore the impact of grade level on each dimension and overall problem-solving skills scores (Table 5). Participants were divided into four groups according to their grade level (fourth grade, fifth grade, sixth grade, and seventh grade). There was a statistically significant difference at the $p < .05$ level in confidence to problem-

solving skills scores for four grade levels F (3, 64) = 4.78, $p < .05$. Besides reaching statistical significance, the actual difference in mean scores between groups was quite large. The effect size, calculated using eta squared, was calculated as .18. Post-hoc comparisons using the Tukey test indicated that the mean score for 4th grade (M = 4.12, SD = .80) and 5th grade (M = 4.12, SD = .55) was significantly different from

Table 5.

Results of Participants' Problem-solving Skills Based on Their Grade Levels

	Grade Level	*M*	*SD*	*F*	*p*	η^2
Confidence	4th	4.12	.80	4.776	.01	.18
	5th	4.12	.55			
	6th	3.82	.66			
	7th	3.34	.71			
Self-control	4th	3.51	.99	3.700	.02	.15
	5th	4.04	.68			
	6th	3.10	.93			
	7th	3.20	1.01			
Avoidance	4th	4.06	.98	5.333	.00	.20
	5th	4.34	.83			
	6th	3.57	.77			
	7th	3.29	.75			
Total Problem-solving Skills	4th	3.93	.63	6.873	.00	.24
	5th	4.14	.49			
	6th	3.56	.59			
	7th	3.29	.67			

7th grade (M = 3.34, SD = .71). According to these results, seventh grade gifted students had difficulties on having confidence toward problem-solving. Their beliefs to themselves about solving problems were not as high as fourth and fifth grade students. Although Saygılı (2014) did not find any difference of gifted students' problem-solving skills level according to the grade level, the present study discovered an important finding thanks to both statistical and practical significance. The

potential reason why confidence to problem-solving skills decreased as grade level increase can be given as their lack of taking suitable education on problem-solving.

In terms of self-control dimension, the results indicated statistically significant differences among grade levels (F (3, 64) = 3.70, $p < .05$) with large effect size. Moreover, Post-hoc comparison using the Tukey test showed that the mean score of 5th grade scores (M = 4.04, SD = .68) was significantly higher than 6th (M = 3.10, SD = .93) and 7th grade scores (M = 3.20, SD = 1.01). The results indicated that 7th and 6th grade students were more likely to give emotional responses to problems as compared to 5th grade students. Therefore, they were unable to control themselves against problems and seeking solutions to them less than how 5th grade gifted students did.

With respect to avoidance dimension scores of the participants, a statistically significant difference was also found (F (3, 64) = 5.33, $p < .05$). Also, eta-squared value of .20 implies a large effect size of the results. In addition, Tukey test as Post-Hoc comparison indicated that 4th grade scores (M = 4.06, SD = .98) and 5th grade scores (M = 4.34, SD = .83) were significantly higher than 7th grade scores (M = 3.29, SD = .75). Similar to confidence dimension, lower grade levels were lower in avoiding solving problems than upper levels. In 4th and 5th grades, gifted students did not prefer avoiding the problem-solving while 6th and 7th grade students did. Also, these results were parallel to finding of Saygılı (2014).

Lastly, overall problem-solving skills scores of the participants were statistically different based on the grade level (F (3, 64) = 6.87, $p < .05$). Eta-square magnitude (η^2= .24) showed a large effect size. Tukey test indicated that 4th grade scores (M = 3.93, SD = .63) were significantly higher than 7th grade scores (M = 3.29, SD = .67), and 5th grade scores (M = 4.14, SD = .49) were significantly higher than 6th (M = 3.56, SD = .59) and 7th (M = 3.29, SD = .67) grade scores. In contrast to Katkat (2001), reporting problem-solving skills increases as grade level increases, the present study results showed that problem-solving skills of gifted students were better in lower grade levels as compared to upper levels. To be more specifically, 4th grade level was better than 7th grade level. As mentioned earlier, insufficient education on problem-solving for gifted students might be a factor that lowering their problem-solving skills down as their grade level rises. Moreover, increasing exam concerns might be another reducing reason to their problem-solving skills.

Conclusion

In this study, it was aimed to investigate the level of gifted students' problem-solving skills as well as identifying whether their problem-solving skill levels differ in with respect to gender and grade level. The results of the study indicated that it is necessary to probe into gifted students' problem-solving skills because their skills were not considerably well enough on the contrary to what is expected based on the

related literate. Moreover, it was also supported that gender is not a key element for gifted students determining their problem-solving skills. Therefore, it can be concluded that there is no need for special efforts in accordance with gifted students' gender during gaining problem-solving skills.

Furthermore, this study revealed that gifted students' level of problem-solving skills differed from each other according to their grade level. Interestingly, lower grades showed higher problem-solving skills as compared to upper levels. This implies that students possess high level of problem-solving skills when they are young and at low grades. However, their skills get lower as they get older and in upper grade levels. From here, it can be deduced that educating these gifted students leads somewhat to diminish their problem-solving skills. A potential reason may be the exam anxiety in Turkey. That is, as they pass to upper grade levels, they are supposed to know and perform much more tasks and skills to be successful in these exams. Thus, these may cause more pressure on them, and decrease their self-confidence which is one of the dimensions of the problem-solving skills. As an alternative explanation, when considered gifted students' program, it may include less tasks and/or activities that develop students' problem-solving skills, as they pass upper grades. For these possible reasons, their problem-solving skills were not found high enough.

Although the study indicates significant results on gifted students' problem-solving skills, there are some limitations of the study. One of these limitations is the size of the sample chosen for this study. Selecting a convenience sample and small size of the sample limits the generalizability of the results to the entire population. In addition, gifted students in the population are constituted from not only those who enrolled in a Science and Art Center but other schools or institutions. Therefore, increasing sample size from all schools may help to external validity of the study. Moreover, due to the fact that this study is a quantitative research, deep information about participants' skills or expression could not completely be obtained.

In the light of the results mentioned in this study, there are several implications for future studies. These are summarized as follows:

- Gifted students' educational program should be revised to develop gifted students' problem-solving skills. Therefore, curriculum revise and improvement in accordance with promoting gifted students' problem-solving skills are necessary.
- Further qualitative studies may shed light on how and why gifted students unable to use or avoid using problem-solving skills.
- To increase generalizability of the results, larger samples from different cultural settings should be included in future research.

References

Akarsu, F. (2004). Gifted and talented. In R. Şirin, A. Kulaksızoğlu, & A. E. Bilgili (Eds.), *A book of selected articles about gifted children* (pp. 97-103). Istanbul, Turkey: Children's Foundation.

Ataman, A. (1998). Üstün Zekâlılar ve Üstün Yetenekliler, *Anadolu Üniversitesi Açıköğretim Fakültesi Yayınları*, 183-185.

Basmacı, S. K. (1998). *Investigation of perceptions of the university students' problem- solving skills based on different variables.* [in Turkish üniversite öğrencilerinin problem çözme becerilerini algılamalarının bazı değişkenler açısından incelenmesi]. Unpublished master's thesis. University of Inönü, Malatya.

Bingham, A. (1958). Improving children's facility in problem-solving (No. 16). Bureau of Publications, Teachers College, Columbia University.

Cutts N. E., & Moseley, N. (2001). *Education of gifted and talented children.* Ankara: Özgür Publications

Çakıroğlu, Ü., Sarı, E., & Akkan, Y. (2011). The view of the teachers about the contribution of teaching programming to the gifted students in the problem-solving. Symposium conducted at the meeting of the 5th International Computer & Instructional Technologies Symposium, (22- 24 September), Elazığ: Fırat University.

Çam, S. (1997). *The effect of communication skills training programme with teacher candidates on ego states and perception of problem solving skill* [in Turkish iletişim becerileri eğitimi programının öretmen adaylarının ego durumlarına ve problem çözme becerisi algılarına etkisi]. Unpublished master's thesis. Ankara University; Ankara

Çapan, E. B. (2010) Metaphoric sensations of teacher candidates about gifted students. *International Social Researches Journal, 3*(12), 140-154.

Davis, G. A., & Rimm, S. B. (1998). *Education of the gifted and talented* (4th ed.). Needham Heights, MA: Allyn & Bacon.

Enç, M. (2005). *Outstanding brain power.* Ankara: Gündüz Education and Publications

Fraenkel, J.R. & Wallen, N. E. (2006). *How to design and evaluate research in education*. McGraw-Hill.

Freeman, J. (1999). Teaching gifted pupils. *Journal of Biological Education, 33*, 185-190.

Genç, H., & Küçük, M. (2003). A case study on the application of the student centered science education program. [in Turkish Öğrenci Merkezli Fen Bilgisi Öğretim Programının Uygulanması Üzerine Bir Durum Tespit Çalışması]. In Proceedings of XII. Educational Sciences Congress, Antalya (pp. 1555-1572).

Gökçe, İ. (2006). *Evaluation of the inner valume of the science and technology curriculum and teacher's guide and the problems faced in the practice (Balıkesir Example).* [in Turkish fen ve teknoloji dersi programı ile öğretmen kılavuzunun içsel olarak değerlendirilmesi ve uygulamada karşılaşılan sorunlar (Balıkesir örneği)]. Unpublished master's thesis. Balıkesir University, Balıkesir.

Hedricks, K. B. (2009). *The impact of ability grouping on achievement, self-efficacy and classroom.* Unpublished doctoral dissertation, Walden Univerity, Walden.

Heppner, P. P., & Baker, C. E. (1997). Applications of the Problem-solving Inventory. *Measurement and Evaluation in Counseling and Development*, *29*, 229-241.

Heppner, P. P., & Krauskopf, C. J. (1987). An information-processing approach to personal problem-solving. *The Counseling Psychologist*, *15*, 371-447.

Johnsen, S. K., & Ryser, G. R. (1996). An overview of effective practices with gifted students in general-education settings. *Journal for the Education of the Gifted, 19*, 379-404.

Johnson, D. T., Boyce, L. N., & VanTassel-Baska, J. (1995). Science curriculum review: Evaluating materials for high-ability learners. *Gifted Child Quarterly, 39*(1), 36-43.

Kanli E., & Emir S. (2009). *The effect of problem based learning in science and technology to the motivation levels of gifted and normal students.* [in Turkish Fen ve teknoloji öğretiminde probleme dayalı öğrenmenin üstün zekalı ve normal öğrencilerin motivasyon düzeylerine etkisi]. *Sakarya Üniversitesi Eğitim Fakültesi Dergisi*, *18*, 42-60.

Katkat, D. (2001). *The comparing with the skills of problem solving from the perspective of different variables for the teacher candidates.* [in Turkish öğretmen adaylarının problem çözme becerilerinin çesitli değiskenler bakımından karsılastırılması.] Unpublished master's thesis, Erzurum University, Erzurum.

Kozandağı, İ. (2001). *The Problems faced in the curriculum of science lesson in the fourth and fifth classes of the elementary schools and the solution suggestions according to the opinions of the teachers.* [in Turkish Öğretmen görüşlerine göre ilköğretim okulları 4. ve 5. sınıf fen bilgisi öğretim programlarında karşılaşılan sorunlar ve çözüm önerileri]. Unpublished master's thesis. Dokuz Eylül University, İzmir.

Lefcourt, H. J., & Loughlin, H. M. (1966). Internal versus external control of reinforcement: A review. *Psychological Bulletin*, *65*, 206-220

Özmen, Ş. G. (2003). *Surveying of science teachers opinions on constructivist learning approach* [in Turkish fen bilgisi öğretmenlerinin yapılandırmacı öğrenme yaklaşımına ilişkin görüşlerinin incelenmesi].Unpublished master's thesis. Hacettepe University, Ankara.

Renzulli, J. S. (1998). A rising tide lifts all ships. *Phi Delta Kappan*, *80*(2), 104.

Rotigel, J., & Fello, S. (2004). Mathematically gifted students: How can we meet their needs? *Gifted Child Today*, *27*(4), 46–51.

Rotter, J. B. (1978). Generalized expectancies for problem-solving and psychotherapy. *Cognitive Therapy and Research*, *2*(1), 1-10.

Saygılı, H. (2000). *The examination of relationship between the skill of problem solving and social and individual adjustment.* [in Turkish Problem çözme becerisi ile sosyal ve kişisel uyum arasındaki ilişkinin incelenmesi]. Unpublished master's thesis. Atatürk University, Erzurum.

Saygılı, G. (2014). Problem-solving skills employed by gifted children and their peers in public primary schools in Turkey. *Social Behavior and Personality: An International Journal*, *42*(1), 53-63.

Schiever, S. W., & Maker, C. J. (2003). New directions in enrichment and acceleration. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (3rd ed., pp. 163-173). Boston, MA: Allyn & Bacon.

Serin, O., Bulut Serin, N., & Saygılı, G. (2010). Developing Problem Solving Inventory for Children at the Level of Primary Education (PSIC). [in Turkish İlköğretim düzeyindeki Çocuklar için Problem Çözme Envanteri'nin (ÇPÇE) geliştirilmesi]. *İlköğretim Online*, *9*(2). 446-458.

Stankov, L., & Roberts, R. D. (1997). Mental speed is not the 'basic' process of intelligence. *Personality and Individual Differences*, *22*(1), 69-84.

Şahin, Z. (2000). A comparative study on children' psychosocial based problem solving skills in terms of various variables. [in Turkish çocukların psiko-sosyal temelli problem çözme becerilerinin çeşitli değişkenler açısından karşılaştırmalı olarak incelenmesi]. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *6*, 451-471.

Taylan, S. (1990). *Adaptation, credibility and validity studies of Heppner's problem-solving inventory.* Unpublished master's thesis, Ankara Universit, Ankara.

Terzi Işık, Ş. (2000). *Investigation of sixth grade students' perceptions of interpersonal problem solving skills in terms of some variables.* [in Turkish İlköğretim Okulu Altıncı Sınıf Öğrencilerinin Kişilerarası Problem Çözme Beceri Algılarının Bazı Değişkenler Açısından İncelenmesi]. Unpublished master's thesis, Gazi University, Ankara.

Toluk, Z., Olkun, S. (2001). *An Examination of Elementary School Textbooks in terms of Developing Problem Solving Skills.* [in Turkish ilköğretim ders kitaplarının problem çözme becerilerinin geliştirilmesi açısından incelenmesi.] X. Educatinoal Science Congress, Abant İzzet Baysal University, Bolu.

Ülger, Ö. E. (2003). *The Relationship Between Leadership Behaviours and Problem solving Abilities of School Managers.* [in Turkish okul yöneticilerinin problem çözme becerilerinin liderlik davranışlarıyla ilişkisi.] Unpublished master's thesis, Istanbul University, Istanbul.

VanTassel-Baska, J. (1994). *Comprehensive curriculum for gifted learners* (2nd ed.). Needham Heights, MA: Allyn & Bacon.

Wilson, S. (2000). *Construct validity and reliability of a performance assessment rubric to measure student understanding and problem-solving in college physics: Implications for public accountability in higher education*. Unpublished doctoral dissertation, University of San Francisco, San Francisco, CA.

Winebrenner, S. (2000). Gifted students need an education, too. *Educational Leadership*, 52-56.

Yangın, S., & Dindar, H. (2007). The perceptions of teachers about the change on elementary school science and technology curriculum. *Hacettepe University Journal of Education, 33*, 240-255.

Yoon, C. H. (2009). Self-regulated learning and instructional factors in the scientific inquiry of scientifically gifted Korean middle school students. *Gifted Child Quarterly*, *55*, 203-216.