



Research Article

A Comparison of Gifted and Non-gifted Students' Self-regulation Skills for Science Learning

Hasan Said TORTOP¹

Received: 08 March 2015 Accepted: 17 May 2015

Abstract

The studies related to what skills are firstly needed to be gained in the gifted students' education are increasing gradually. The gifted individuals' being independent learners are desirable situation. Self-regulation skills are a set of abilities that help a person to control and monitor their own behavior, thoughts and changing flexibly them in accordance with the demands of the situation. When viewed from this aspect, it can be said that self-regulation skills should be gained in the educations of the gifted students. In this study, a Self-regulation Skills for Science Learning Scale (SSLS) has been developed by researcher. Thanks to this scale, the self-regulation skills of the gifted students and non-gifted in learning science have been compared. The sample of the research has been determined in accordance with purposeful sampling method. Non-gifted students are the students who study in two schools determined according to typical sampling method in a province the socio-economic level of which in Turkey is medium-scale. The gifted students are those who enrolled in Science and Art Centre that gives education to the gifted students in the same province. 264 students have been determined at the level of 4th to 8th grade in the sample of the research. As the result of research findings, it has been determined that gifted students' self-regulation skills for science learning are higher than the non-gifted students. It has seen that there are significant differences between the self-regulation skills points of both groups in science learning ($p < 0.001$). However, a significant difference hasn't been seen at the metacognitive skills dimension that is one of the sub-dimensions of the scale ($p > 0.05$). The metacognitive skills contain very important skills (e.g. goal setting, monitoring, self-assessment, regulation) on the nurturing of talent. The students' not having differentiation in the scores of metacognitive skills can be indicator that available gifted education programs doesn't have the quality to develop these skills.

Key words

gifted education, self-regulation skills for science learning, gifted and non-gifted students

To cite this article:

Tortop, H. S. (2015). A comparison of gifted and non-gifted students' self-regulation skills for science learning. *Journal for the Education of Gifted Young Scientists*, 3(1), 42-57. DOI: <http://dx.doi.org/10.17478/JEGYS.2015112017>

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¹ Assoc. Prof., Bulent Ecevit University, Faculty of Education, Division of Special Education, Zonguldak, Turkey. E-mail: hasansaid@yahoo.com

INTRODUCTION

In recent years, how the individuals learn, how they arrange their learning and the assessment requirements of their own learning activities brings the concept of self-regulated learning into the forefront (Zimmerman & Schunk, 2004). Flavell (1979) explained this concept as the individual's own thinking way and behaviours to be organized and to be aware of by them. There are thoughts that these thinking skills conceptualized as Self-regulated learning are key qualifications for the gifted students today (Obergrösser, Steinbach & Stoeger, 2013; Risemberg & Zimmerman, 1992). Firstly, the theoretical framework of the self-regulated learning will be presented, then the relationship of the concept of the giftedness with self-regulation theories will be explained.

Theoretical Framework of the Self-regulation Skills

How can students be managers of their own learning processes as one of the basic principles of social-cognitive theory and the concept of self-regulated learning? It has come out to find answer of the question. This concept has widened its own studying area by taking many similar concepts (self-control, self-management) along with it. Self-regulation skills contains skills such as student's using their times effectively in their learning processes, establishing a relationship between information units, being able to set their own learning goals, being able to motivate themselves (Zimmerman, 2001; Boekaerts, Pintrich & Zeidner, 2000; Cheng, 2011). In learning processes of students, focus their attention on learning, time management (using their effectively and efficiently), self-confidence, establishing a relationship between the information unities, setting goals of learning and strategies by a person's own, the ability to gain skills like organizing their learning and reaching their learning goals are closely related to self-regulation (Cheng, 2011).

Self-regulated learning provides opportunity to students to gain academic skills, set a target, select a strategy, develop strategy and observe them effectively (Zimmerman, 2002a). In the learning model based-on self-regulation that Zimmerman (1998) developed, it is known that self-regulation has a circular nature. By stating that it affects many processes such as students' setting the goals related to learning tasks, developing a affective attitude, strategy selection, determining the time to be allocated to the task and effort to be spent, he expresses it as a circular process consisting of the stages such as the learning based-on self-regulation, consecutive, forethought, performance or volitional control and self-reflection.

The Characteristics of the Students Who have Self-Regulation Skills

- They have the management skills to use resources effectively (to achieve efficient learning)
- They can setting goals for their learning.
- They adopt the goals that they have determined; they can develop a task commitment and responsibility (self-determination)
- They can evaluate their own performances (self-evaluation)
- They can provide increasing their motivations
- They can provide increasing their self-efficacy
- They can increase their efforts for their learning
- They can determine their own strengths and weaknesses (self-monitoring)
- They can use their times effectively (self-management) (Bandura, 1994; Zimmerman, 2002b; Pittrinch, 2004; Schunk, 2009)

The students who gain their self-regulation skills show higher success than other students. This situation increases the possibility of gaining high success on academic and professional fields in the future. In this case, making students gain self-regulation skills should be among the primary objectives of the education institutions (Zimmerman, 2002b; Ruban & Reis, 2006).

Giftedness and Self-Regulation Skills

One of the important subjects that the researchers have come to an agreement on the giftedness, general intelligence capacity (g) is required for "giftedness" (high ability and productivity), however it is not enough (Sternberg & Davidson, 2005; Tannenbaum, 2003). Today, a discussion gaining dimension with Gardner's (1983, 1999) studies and with the views of important theorists (Renzulli, 1986; Gagne, 2004) who put forth theoretical framework to giftedness leads the researchers to the conclusion that giftedness is to be on special field (Winner, 1996, 2009). The researchers who have tried to constitute a general agreement related to giftedness have brought forward the thoughts and contemporary approaches related to that giftedness is a developmental process requiring performance (Horowitz, Subotnik & Matthews, 2009; Cross, 2011; Mayer, 2005). Ability/talent is firstly required for the giftedness. There are requirements such as task commitment on the field, using appropriate instructional methods/strategies, developing psychosocial skills, spending time (Sosniak, 1990; Cross & Coleman, 2005; Gagné, 2005; Syed, 2010; Renzulli, 1978). The subject that the researchers study on the

educations of the gifted have urged upon mainly is what the factors are that influence the emergence of giftedness performance (Subotnik, Olszewski-Kubilius & Worrell, 2011; Gagne, 2004; Simonton, 2001). Tannenbaum (1986) highlighted that the giftedness has cultural and social dimension specifies that while talking about the giftedness in societies. However, it is not much focused on the subject of spending time about emergence of giftedness (Sosniak, 1990).

There can be intersection points between self-regulation skills -that will be defined simply as a person's controlling their own learning and managing- with the concept of the giftedness and the education of the gifted students. An examination at conceptual framework related to these intersection points has been made below.

Creativity: As a Concept in Theory of the Giftedness and the Self-Regulation

The creativity that is the ability to put forth new ideas and solution proposals finds its own place in the theories of the giftedness (Renzulli, 1977, 1986; Stenberg, 2005). According to Amabile (1996) creativity consists of three components. It is a knowledge and skill on a specific field, task commitment and creative process. Likewise, *task commitment* confronts with us in Renzulli's (1977, 1986) theory of giftedness. The fact that creativity will be able to emerge with a lifelong developmental process is specified even by Simonton (2000). On one hand, acquiring self-regulation skills requires a process; on the other hand the individuals who acquire self-regulation skills may be very productive members on that field by showing persistence and determination in order to achieve the specific goals (Zimmerman, 2002; Ruban & Reis, 2006). Gaining self-regulation skills and self-control need to task value, focus on goals, task commitment and persistence in difficult tasks. So, it can be said that self-regulation and creativity intersect in terms of requirements of task commitment and requiring a development process conceptually at both theories

For a person being in the situation of nurturing creativity process and dedication to task that are seen in the theories of the creativity takes us to the idea where there is similar conceptualization such as goal setting and goal orientation, task value, task dependence that are seen in theories of the self-regulation. Most people whom we can say creative person have spent long times for their educations (Howard, 2008; Syed, 2010; Walberg, Williams, & Zeiser, 2003, Renzulli, 1986). In addition to this, creativity requires continuity. In other words, there is a relationship between the creativity in the childhood (little-c) and the creativity in the adulthood (Big-C) (Cramond, Matthews-Morgan, Bandalos, & Zuo, 2005; Plucker, 1999; Runco, 1999). This situation takes us to concentrate on the processes-like task commitment- revealing the creativity which is a component of giftedness theories. This can be show the intersection point of theories of the self-regulation and the giftedness to us.

Motivation: As a Concept in Theory of the Giftedness and the Self-Regulation

When it is looked at the some theories about giftedness, it is seen that motivation is within certain theories of the giftedness. A dimension of Renzulli's (1977, 1986) Three Ring Theory takes motivation in hand. Csikszentmihalyi (1985)'s opinion related to *the similar side of many inventors and genius people is not their cognitive and affective side but is just the motivation*, has caused to give importance to this concept in the education of gifted students. However, Renzulli (1977, 1986) doesn't urge upon the multi-comprehensive structure of motivation but urges upon task commitment. Task commitment can be defined as the willingness, persistence, and self-confidence of a person in a field and his/her willingness to solve the problems s/he meets. It is seen that gifted students have more personal characteristic about task commitment and self-regulation than their peers, so, that these characteristics contribute to show higher performance (Ericson et al., 1993; Curby, Rudasill, Rimm-Kaufman & Konold, 2008).

Gagne's (2005) theory' of Differentiated Model of Giftedness and Talent (DGMT) takes concept of the motivation in hand under the title of individual catalysts and he defends that the motivation effects to transform gift into talent in his theory. It has been seen that gifted students showing high success have high motivation (Davis & Rimm, 1998). Low motivation is one of the problems met in gifted students frequently. They can use strategies such as successive achievements, constituting personal relations, goal setting in order to cope with low motivation (Sak, 2010). Goal setting and self-directed skills should be taught in the education of gifted students (Siegel & McCoach, 2005; Webb, Meckstroth & Tolan, 1994; Withmore, 1986; Sak, 2010). Likewise, concept of the motivation seen to take place in theories of the giftedness (Renzulli, 1977, 1986; Gagne, 2005), in the education of gifted students (Siegel & McCoach, 2005; Sak, 2010) and in the self-regulated learning theories (Pitrich, 2000; Risemberg & Zimmerman, 1992; Heller, 1999; Zimmerman & Martinez-Pons, 1990).

In the successes of the gifted students, the studies related to the effect of motivation and motivation sources are increasing rapidly (Covington & Dray, 2002; Kover & Worrell, 2010). In this respect, it can be thought that bringing the self-regulation skills in the education of gifted students should be taken place as an important component (Tortop & Eker, 2014).

Giftedness, Underachievement, Hidden Gifted and Self-regulation

Underachievement and hidden gifted are the concepts that are often encountered in gifted students. Is there any relation of these concepts with self-regulation skills? Underachievement is seen more in gifted students than normal students (Sak, 2010, Withmore, 1980, Rimm, 2003). The success of gifted students being under cognitive capacity or the (un)success shown below expectation, can be explained as underachievement. Low motivation and deficiency in the use of metacognitive strategies may cause the emergence of this phenomenon (Renzulli & Park, 2002; Rimm, 2003; Reis, 1998; Withmore, 1980). Hidden gifted phenomenon is one of the important problems in the education of gifted students (Davis & Rimm, 1998). This is the situation of gifted students' hiding themselves because of incorrect diagnosis, being different culture and twice exceptionality status (Moltzen, Riley, & McAlpine, 2000; Davis & Rimm, 1998). Special learning difficulties (ADDH, dysgraphia, discalculy e.g.) can be among the reasons of these phenomena (Rimm, 2003; Karnes & Johnson, 1991). It has been seen in the studies recently that self-regulation theory have given positive contributions on the solutions of underachievement and hidden gifted problems. Stoeger and Ziegler (2005) has determined that self-regulated learning programs have brought positive effects for the gifted underachievement students. The cases about not emergence of giftedness phenomenon and the causes underlying the underachievement and hidden gifted phenomenon are self-regulation skills and these concepts show us that they are interrelated with each other.

Structures of the Education Program Model for the Gifted Students and Self-Regulation

The scientists came up with the education models that take the theories of giftedness as basis such as Purdue Three Stage Model (Feldhusen & Kollof, 1986), Enrichment Triad Model (Renzulli, 1977), Autonomus Learning Model (Betts, 1986; Betts & Krecher, Education Program for Gifted students Bridge with Universty (EPGBU) (Tortop, 2013a). These models have been proposed in order to contribute the development of gifted students. Well, is there relation between the structure of these programs and self-regulation?

Purdue Three Stage Model was designed by Feldhusen and Kollof (1986). This model consists of three phases. In the first phase, it focuses on the development of basic thinking skills and field information. In this phase, the studies are made related to developing the convergent and divergent thinking skills. In the second phase, it focuses on developing critical thinking, problem-solving skills. Activities are done for it. In the third phase, ability to study independently is required and the gifted students some products at the end of this phase

Autonomus Learning Model suggested by Betts (1986). This model consists of five steps. The purpose of this model is to provide the gifted students being a person making independent study and autonomus learners. On the adaptation phase, the students are aware of their abilities. It gives the skills providing autonomus learning on the individual development stage. On the enrichment stage, it provides students to make investigations and discoveries extracurricular. On the seminar stage, the students present the investigations that they have done in front of groups. On the indepth-study stage, students make in-depth investigations upon their requests.

Enrichment Triad Model was put forwarded by Renzulli (1977) (Renzulli & Reis, 1997). There are three types of activities in this model. In Type 1, the activities that are not in general programs are done. Students are intended to draw the attention to specific issues. In Type 2, it aims to develop research, thinking skills of the students. In Type 3, it is the stage that students do individual work. In this stage, it aims to develop the planning skills, management skills (source and time), and so forth.

Education Program for Gifted students Bridge with Universty (EPGBU) Model was put forwarded by Tortop (2013). EPGBU is a program aiming at –educating as a scientist-academically gifted students. It consists of three stages, and EPGBU is based on mentoring and e-mentoring educational approach. The persons to be determined as a mentor in EPGBU model both they can be the teachers (who have made post graduate education) from Science and Art Centres and Science and High School in Turkey and they can be students who enrolled faculty of education at university. However, the persons to be assigned as e-mentor should be scientists who work in any field of science, besides (s)he have an important successes (Tortop, 2013a, 2013b). EPGBU presents an education consisting of three stages with thematic approach in the teaching process. These stages are; teaching process consists of three phases. Scientific Fields & Mentor Determining Period, Deepening in the Science Specialty and Research Design Period, Scientific Research and Reporting Period (Tortop, 2013a, 2013b, 2014). EPGBU model is the first program involving of the self-regulation skills for the education of the gifted students in Turkey. It is thought that self-regulation skills should be brought to educate academically gifted students as a scientists in EPGBU model. In EPGBU model, especially in 1th to 4th grade students groups, activities and studies are applied in order to nurture their self-regulation skills. It is proposed that these skills, ideally, should be taught during primary school period or in the first stage of gifted students' education programs (Obergruesser, Steinbach, & Stoeger, 2013).

When looking at the model programs of the education of gifted students, it is basically aimed that individuals being an autonomous and independent learners. For this reason, it need to gain self-regulation skills to gifted students. In the view of this points, the idea that the self-regulation skills should be one of the important components in the education of gifted students may come out (Obergruesser, Steinbach & Stoeger, 2013; Zimmerman, 2002a).

Self-regulation Skills for Science Learning

It is accepted that the self-regulation skills is one of the skills that should be nurtured at education of the academically gifted students (Risemberg & Zimmerman, 1992; Obergruesser, Steinbach, & Stoeger, 2013; Tortop, 2013a). Self-regulation skills for science learning may be higher in gifted students than non-gifted students, so gifted students' epistemological beliefs are more developed than non-gifted students naturally (Neber & Schommer-Aikins, 2002). However, developing these skills should be taken place as curriculum component for the education of gifted students explicitly (Obergruesser, Steinbach & Stoeger, 2013; Tortop & Eker, 2014).

This study aims to compare the self-regulation skills of gifted and non-gifted students for science learning. In this study, it is sought answers to the following research problems;

- Are there significant differences between gifted and non-gifted students' self-regulation skills for science learning?
- Are there significant differences in subscale scores of gifted and non-gifted students' self-regulation skills for science learning?

METHOD

Research Model

In this study, survey model was used to determine gifted and nongifted students' self-regulation skills in science learning varied or not according to various variables (Buyukozturk et al., 2011).

Sample

While determining the sample of the research, purposeful sampling method from the proposal sampling methods has been used. In accordance with the typical sampling methods for non-gifted students, the students have been determined in two schools from one province being in middle level socio-economically in Turkey. Criterion sampling methods have been used for determining gifted students. The criteria related to the diagnosis of giftedness have been put for students. These students have been determined as the students taking 130 and over score from WISC-R test. These students are still registered in Science and Art Centre as support education in Turkey (MNE Science and Art Directive, 2007). Total 264 gifted and non-gifted students have been reached. The sample size was adequate in terms of the stipulation that sample size should be 5 or 10 times the number of items in the scale (Buyukozturk et al., 2011).

Data Collection Tools

Self-regulation Skills for Science Learning Scale (SSLS): The scale was developed to determine students' self-regulation skills for science learning. The Self-regulation Skills for Science Learning Scale (SSLS) was administered to primary (3rd-4th grade) and secondary (5th - 8th grade) school students in Turkey. But, it presented that developing process of SSLS as follow;

Firstly, theoretical framework has been constituted for developing the scale of self-regulated science learning skills. Motivated Strategies for Learning Questionnaire (MSQL) scale developed by Pintrich, Smith, Garcia and Mc Keachie (1991) developed similar to theoretical framework has been taken into consideration. There are 81 items and 3 sub-dimensions in this scale. These are Motivational Beliefs Dimension, Cognitive and Metacognitive Self-regulation Dimension, Resource Management Strategies Dimension.

Table 1. Structure of motivated strategies for learning questionnaire (MSQL) (Pitrinch et al, 1991, Altun & Erden, 2006)

Cognitive and Metacognitive Strategies	Motivational Beliefs	Resource Management Strategies
Rehearsal	Intrinsic Goal Orientation	Time and Study Environment
Elaboration	Extrinsic Goal Orientation	Effort Regulation
Organization	Task Value	Peer Learning
Critical Thinking	Control Belief	Help Seeking
Metacognitive self-regulation	Self-efficacy	
	Test anxiety	

The theory constituting the basis of the scale claims that the self-regulation skill is in context-oriented structure changing from class to class and from subject to subject (Pintrich et al., 1993). Therefore, it is suggested to evaluate self-regulation skills in the context of course or field.

It is thought that, as it is in Pitrinch (1991), the scale should be separated including “cognitive skills” and “metacognitive skills” of cognitive and metacognitive strategies in the first dimension. It has been decided that the scale should have 4-dimensional structure with its final version theoretically (see Figure 1).



Figure 1. Dimension of Self-regulation Skills for Science Learning

It is considered that the scale thought to be developed should also be used for determining the gifted students in the academic field. In this respect, the concept of “skills” has been used instead of the concept of “strategy” used in the scale. If “skills” evoke more behavioural connotation, in fact, it is defined at *The Literacy Dictionary* as “skill is also used to refer to parts of acts that are primarily intellectual, as those involved in comprehension or thinking. (Harris & Hodges, 1995, p. 235). In particular, note that *skill* is associated with the proficiency of a complex act, and *strategy* is associated with a conscious and systematic plan (Afflerbach, Pearson, & Paris, 2008). The concept of self-regulation skills have been used by the founders of self-regulation theory (such as; Ramdass & Zimmerman’s (2011) study entitled *Developing Self-Regulation Skills: The Important Role of Homework*). When it is thought that the concept of skills is in the education of gifted students, it is needed to focus more on these kinds of conceptualizations. One student can learn and develop these skills personally. In particular, gifted students’ acquiring these skills will provide them to get very important successes and give important products in certain areas (Risemberg & Zimmerman, 1992).

After the theoretical framework created, firstly the author made a comprehensive and extensive review of the related literature and of the existing surveys about self-regulated learning. A number of studies on the self-regulated learning (Pintrich & De Groot, 1990; Pintrich et al., 1991; Clearly, Callan, & Zimmerman, 2012; Smith-Donald, Raver, Hayes, & Richardson, 2007; Ryan & Connell, 1989; Black & Deci, 2000; Bas, 2007). And the item pools has been constituted, the initial draft was consisted of 24 items. The draft was sent to the experts in educational psychology and to the researchers who frequently studied on the self-regulated learning and gifted education in order to check in the respect of content relevance, readability, and consistency. The draft was revised by author, and each items was regulated their views. The final instrument consisted of 24 positive items. This scale is a 5-point Likert type scale which rated as 1 strongly disagree, 2 disagree, 3 undecided, 4 agree, 5 strongly agree. The higher score on scale indicated more self-regulation skill for science learning.

Sample

The study was carried out with 208 students enrolling in the A city of Turkey in the spring term of the academic year of 2012-2013. There were 117 female students and male 91 students. In scale-developing studies, sample space should be 2-5, preferably 10 fold of questionnaire item number (Klien, 1994; Buyukozturk et al., 2010).

Validity

The final version of the instrument was administrated to 208 students. Afterwards, exploratory factor analysis was conducted. The Kaiser-Mayer Olkin (KMO) measurement of the sample adequacy and Barlett's test of sphericity were calculated. The KMO coefficient was found to be .91, which was higher than the critical value of 0.3 (Klien, 1994; Buyukozturk, 2007). The result of Barlett's test of sphericity statistic was significant ($p < 0.05$). It seemed that factor analysis could be applied to the results of these tests. The purpose of applying factor analysis was to determine the number of separate components. Whether the test demonstrated a normal distribution or not was examined. As there was no normal distribution, the principal axis factoring analysis was used on all the data to extract the appropriate number of factors. The principal axis factoring analysis yielded four components with an eigen value greater than one (Stevens, 1996; Colakoglu & Buyukeksi, 2014). These factors explained 65.49 of total variance. The varimax rotation was administrated due to there was not any relations between subscales with one another (Colakoglu & Buyukeksi, 2014), and factor loadings for each item were examined. The items with a loading less than 0.30, those loaded on more than one factor or those whose communality values decreased excessively were excluded (Klien, 1994; Buyukozturk, 2007). At the end of study, the factor analysis revealed four independent factor structures. The factor structures and loading of 21 items in SSSLS are given Table 2. The factor structures and loading of 21 items in SSSLS are given Table 2.

Table 2. Factor structures and loading of the 21 items in SSSLS

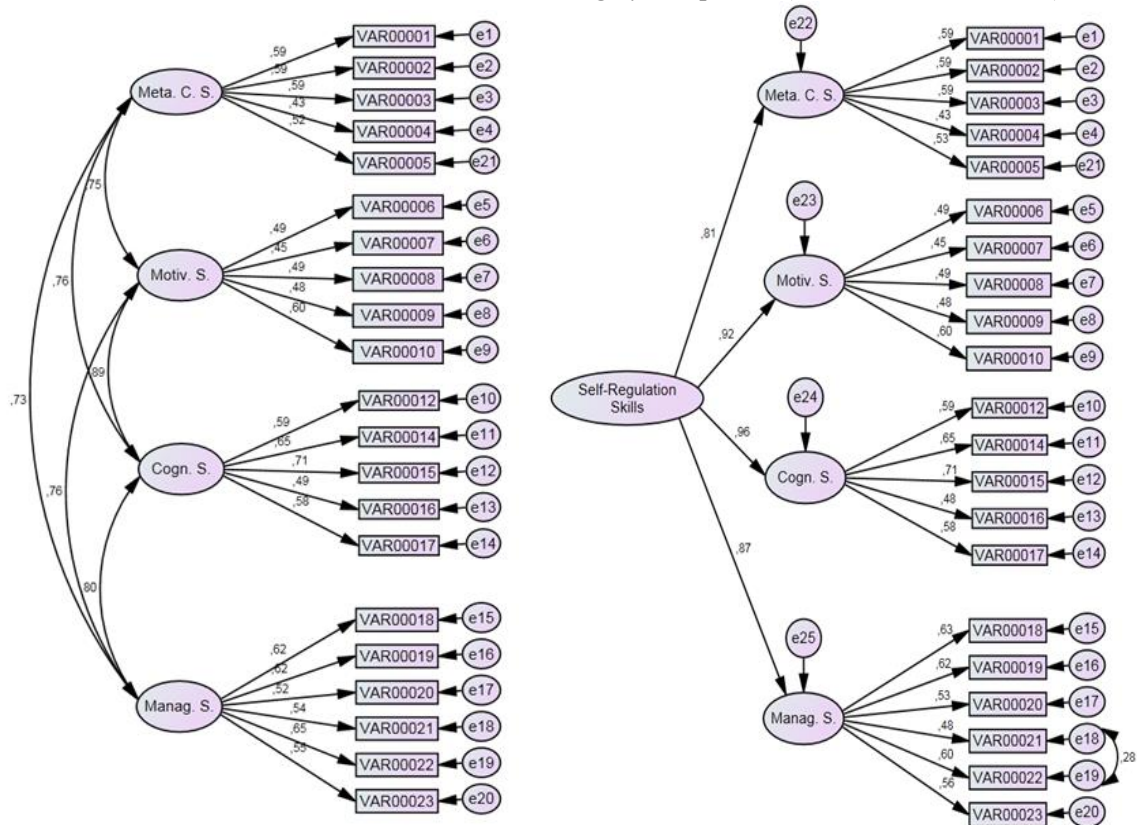
	Factor 1	Factor 2	Factor 3	Factor 4
While learning science;				
Item 2 ... I define the points in which I am successful or not	.782			
Item 3 ... I define the topics that I am good or bad at	.763			
Item 5 ... I check what I've learned or not	.720			
Item 4 ... I revise the topics that I've learned	.672			
Item 1 ... I define what I am going to learn first	.577			
Item 6 ... I know that my learning is important for me		.856		
Item 9 ... I am eager to learn the things that I am curious about		.668		
Item 7 ... I know that the time that I spent for learning is valuable		.666		
Item 10 I believe that I will gain great achievements in Science		.592		
Item 8 ... I stick to the topics/fields that I specialize		.503		
Item 17 ... I make everything that I've learned fit together			.779	
Item 16 ... In my mind, I organize the information that I learned			.757	
Item 15 ... I make my learnings meaningful for me			.637	
Item 14 ... I connect things I'm learning about with what I already know			.606	
Item 12 ... I reexamine my notes that I've taken			.581	
Item 21 ... I set a timetable/schedule for studying				.821
Item 23 ... I identify institutions and persons that I can get help				.771
Item 20 ... I set aside an environment that makes me learn easier				.731
Item 22 ... I know how to plan my time				.727
Item 19 ... I deliberate upon a topic that I did not understand				.581
Item 18 ... I cope with the difficulties that I meet				.476

As can be seen in Table 2, SSSLS consisted of four factors. There were five items (with items 1, 2, 3, 4, 5) clustered as Factor 1, five items (with items 6, 7, 8, 9, 10) clustered as Factor 2, three items (with items 12, 14, 15, 16, 17) clustered as Factor 3, and six items (with items 18, 19, 20, 21, 22, 23) clustered as Factor 4. Then, these factors were labeled as Factor 1: Metacognitive Skills, Factor 2: Motivational Skills, Factor 3: Cognitive Skills, and Factor 4: Management Skills.

Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) was conducted to test whether the specific factorial structure of the SSSLS was compatible with the obtained model from Exploratory Factor Analysis (Barrett, 2007). Another sample has

been used to conduct CFA for obtaining data at 2014-2015 educational term in Turkey. AMOS 20.0 program was used for confirmatory factor analysis. CFA fit indexes was examined and interpreted (Byrne, 2011). The results of confirmatory factor analysis indicated that the model (Model 1; see Figure 2 at left) was well fit and Chi-Square value ($\chi^2=318.706$, $N=263$, $df=183$, $p=0.00$) which was calculated for the developed of the model was found to be significant (See Figure 2). Based on this, four-factor structure of SSSLS has been validated. Fit indexes of the model were found to be $RMSEA=0.053$, $\chi^2/df=1.74$, $NFI=.80$, $CFI=.90$, and $GFI=.90$. CFA results indicated that $RMSEA$, NFI , CFI and GFI were highly compatible (Hoe, 2008; Kline, 1998). Besides, the second order factor structured examined. One modification conducted at this model. The results of CFA indicated that the model (Model 2; see Figure 2 at right) was well fit and Chi-Square value ($\chi^2=303.691$, $N=263$, $df=184$, $p=0.00$) which was calculated for the developed of the model was found to be significant (Byrne, 2011). Fit indexes of the model were found to be $RMSEA=0.050$, $\chi^2/df=1.65$, $NFI=.80$, $CFI=.91$, and $GFI=.90$. CFA results indicated that $RMSEA$, NFI , CFI and GFI were highly compatible (Hoe, 2008; Kline, 1998).



$\chi^2=318.706$, $df=183$, $p=0.00$, $RMESA=0.053$ $\chi^2=303.61$, $df=184$, $p=0.00$, $RMESA=0.050$
Figure 2. SSSLS CFA results (Model 1) and SSSLS second order model CFA results (Model 2)

Reliability

Following the factor analysis, reliability analysis was conducted for each factor, and Cronbach alpha coefficients were calculated. Internal consistency coefficients were for the 21 items for each subscale 0.87, 0.85, 0.87, and 0.87, respectively, and the explained variances were found to be 44.88, 9.74, 5.99, and 4.88, respectively. Total variance of SSSLS was 65.49, and the Cronbach alpha coefficient was calculated as 0.94. Item-total statistics analysis revealed that all items were highly related ranged between 0.54 and 0.74. Correlational analysis revealed that all subscales and SSSLS were highly related ranged between 0.611 and 0.846 (see Table 3).

Table 3. Correlation of SSSLS and subscales

	SSSLS	Factor 1	Factor 2	Factor 3
Factor 1	.831**			
Factor 2	.845**	.546**		
Factor 3	.850**	.715**	.618**	
Factor 4	.832**	.543**	.686**	.533**

** Correlation was significant at the level of 0.01 (2-tailed).

Item analysis results demonstrated that item-total correlations ranged from 0.54 to 0.74. Independent groups t-test was performed to compare all items' means for upper 27% and lower 27% of the group points. It was found out that, there was a significant difference for all items ($p < .001$). Besides it was seen that students' SSSLS points were differentiated from gender variables ($t_{(206)} = 1.967$, $p < 0.00$) (Table 4).

Table 4. t- Test results of students' SSSLS points according to gender

	N	Mean	Std. Deviation	df	t	p
Male	91	82.56	16.34	206	1.967	.048
Female	117	86.54	12.83	167.209		

Determining for criterion validity of SSSLS, correlation with MSQL, which developed (Pitrinch & De Groot, 1990) and adapted Turkish language Uredi (2005) to measure self-regulated strategies of students, has been examined. It was found that there was a positive and significant correlation with students self-regulated strategies scores and students' self-regulation skills for science learning ($r = 0.81$, $p < 0.01$).

This study was carried out to develop a scale for students' self-regulation skills for science learning. The findings obtained from the validation studies revealed that this scale was valid. The fact that the internal consistency coefficient of the scale was found to be 0.94 which showed that the scores to be taken from the scale were consistent with each other, therefore the reliability of internal consistency was normal level (Klien, 1994; Buyukozturk, 2007). The results for item-total statistics analysis demonstrated that the item-total correlations of the scale ranged between 0.54 and 0.74. According to research it could be said that SSSLS was a valid and reliable tool. In the light of the findings, SSSLS can be used in studies for measuring students' self-regulation skills in science learning. In addition, there is no scale development study carried out with students in related literature. In this respect, the scale developed in the present study will bridge an important gap in studies regarding the gifted or non-gifted students' self-regulation skills for science learning.

Data Analysis

To determine groups' differences of the students' self-regulation skills for science learning scores, SPSS was used for the analysis, frequency, mean, t-Test.

RESULTS

In this study, gifted and non-gifted students' self-regulation skills in science learning has been compared. Besides, the differences in the scores of metacognitive skills, motivational skills, cognitive skills, management skills sub-scales that are the sub-scales of self-regulation skills in learning science have been examined, too (see Table 5).

Table 5. The results of independent group t-Test to significance in the self-regulation skills in science learning between gifted and non-gifted students

	Variables	N	Mean	Ss.	df	t	p
SSSLS Mean Scores	Non-gifted	180	4,19	,539	261	-3,387	,001**
	Gifted	83	4,41	,405			
Metacognitive Skills Mean Scores	Non-gifted	180	4,20	,662	261	-,613	,540
	Gifted	83	4,25	,579			
Motivational Skills Mean Scores	Non-gifted	180	4,33	,556	261	-4,651	,000**
	Gifted	83	4,65	,392			
Cognitive Skills Mean Scores	Non-gifted	180	4,11	,672	261	-3,807	,000**
	Gifted	83	4,44	,596			
Management Skills Mean Scores	Non-gifted	180	4,12	,712	261	-2,349	,020*
	Gifted	83	4,33	,576			

* $p < .005$ ** $p < .001$

As it is seen in Table 5, gifted students' self-regulation skills mean scores are $\bar{X} = 4.41$, non-gifted students' self-regulation skills mean scores are $\bar{X} = 4.19$. As it is shown in Table 5, there is significant difference between gifted students' self-regulation skills mean scores and non-gifted students' self-regulation skills mean scores ($t_{(261)} = 3.387$, $p < 0.001$). Besides, there is significant difference between three sub-scale of SSSLS, these are motivational skills sub-scale, cognitive skills sub-scales, management skills sub-scales ($p < .001$, $p < .05$). But, as it is seen in Table 5, gifted students' metacognitive skills mean scores are $\bar{X} = 4.25$, non-gifted students' self-regulation skills mean scores are $\bar{X} = 4.20$. As it is shown in Table 5, there is no significant difference between gifted students' metacognitive skills mean scores and non-gifted students' self-regulation skills mean scores ($t_{(261)} = .613$, $p > 0.05$).

DISCUSSION AND CONCLUSION

In this study, the self-regulation skills of gifted students and non-gifted students for science learning have been compared. The research findings have showed significant differences between the self-regulation skills of gifted students and non-gifted students ($t_{(261)} = 3,387, p < .001$). In the research, it has been seen that the self-regulation skills of gifted students are higher than non-gifted students. It is known that gifted students are a self-employed (autonomy) individual who has motivated himself/herself and manages his/her own learning (that s/he uses self-regulated learning (Clark, 1992; Risemberg & Zimmerman, 1992; Heller, 1999; Zimmerman & Martinez-Pons, 1990; Ablard & Lipschultz, 1998).

How to make them acquire the self-regulation skills are among the important problems. Maker and Nielson (1995) has stated that real life problems should be applied in order to make gifted students acquire self-regulation skills. Neber and Schommer-Aikins (2002), in his research, has researched the variables that may be effective in self-regulated science learning and differentiation situation in terms of self-regulated science learning, in terms of gender and class level. He hasn't found significant differences in gender variables. However, they have specified that the motivational preconditions should be widened in learning environments and the learning environments where the researches to be started by the students themselves are made should be constituted. Self-regulated education programs (Zimmerman, et al., 1996) have been applied to 36 fourth class underachievement students. Especially, even though there has passed only one week, it has been seen that there has been improvement in time management skills and self-regulated learning. It has been seen that self-regulated learning has been effective in terms of transforming the potentials of underachievement gifted students into performance (Stoeger & Ziegler, 2005). In a study that the effects of self-regulated reading on gifted students are examined, it has been observed that high-level thinking skills have been increased in the group that self-regulated reading is made (Housand & Reis, 2008). Zimmerman (2002b) specifies that individuals should regulate their talents by themselves when encountered especially with making long-scaled creative projects (a invention, an art work or literary work).

In the research, even though there seems difference in total point in self-regulation skills of gifted students and non-gifted students for science learning, significant differences haven't been seen in metacognitive skills points ($p > 0.05$). This situation is quite thought provoking. It is important in this respect for gifted students to take education for nurturing their metacognitive skills (skills such as goal setting). Many researches show that the increase in self-regulation skills occurring as a result of supportive educations of gifted students' self-regulation skills has brought positive effects. Gifted students need self-regulation skills and educational support to increase motivation and they deserve this (Davis & Rimm 1998; Housand & Reis, 2008; Treffinger, 1975; Zimmerman & Martinez-Pons, 1990). It is quite important in this respect to give education to academically gifted students in relation to bringing self-regulation skills in learning science. In the research, the findings related to absence of differences in metacognitive skills scores of gifted students and non-gifted students, it can be interpreted that is inadequate on developing self-regulation skills to gifted students in Science and Art Centres established for the education of gifted students in Turkey. Therefore, the programs like EPGBU model that self-regulation skills are given in the education of gifted students are needed (Tortop & Eker, 2014). It is appeared that the studies related to the education of gifted students and self-regulation skills in literature are few. Increasing the number of studies in this field can be suggested to researchers.

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Appendix 1. Self-regulation Skills for Science Learning Scale (SSSLS)

Self-regulation Skills for Science Learning Scale (SSSLS)	
While learning science;	
1	... I define the points in which I am successful or not
2	... I define the topics that I am good or bad at
3	... I check what I've learned or not
4	... I revise the topics that I've learned
5	... I define what I am going to learn first
6	... I know that my learning is important for me
7	... I am eager to learn the things that I am curious about
8	... I know that the time that I spent for learning is valuable
9	I believe that I will gain great achievements in Science
10	... I stick to the topics/fields that I specialize
11	... I make everything that I've learned fit together
12	... In my mind, I organize the information that I learned
13	... I make my learnings meaningful for me
14	... I connect things I'm learning about with what I already know
15	... I reexamine my notes that I've taken
16	... I set a timetable/schedule for studying
17	... I identify institutions and persons that I can get help
18	... I set aside an environment that makes me learn easier
19	... I know how to plan my time
20	... I deliberate upon a topic that I did not understand
21	... I cope with the difficulties that I meet

Sub-dimensions

1. Metacognitive Skills : 1., 2., 3., 4., 5., items
2. Motivational Skills : 6., 7., 8., 9., 10., items
3. Cognitive Skills : 11., 12., 13., 14., 15., items
4. Management Skills : 16., 17., 18., 19., 20., 21., items

Appendix 2. Self-regulation Skills for Science Learning (SSSLS) (in Turkish)

Bilim Öğrenmede Özdüzenleme Becerileri Ölçeği	
Bilim öğrenirken;	
1	... başarılı ve başarısız olduğum yerleri belirlerim
2	... iyi ve zayıf olduğum konuları belirlerim
3	... öğrenip öğrenmediğim konuları kontrol ederim
4	... öğrendiğim konuları yeniden gözden geçiririm
5	... öncelikle neleri öğreneceğimi belirlerim
6	... öğrendiklerimin benim için önemli olduğunu bilirim
7	... merak ettiğim şeyleri öğrenmeye istek duyarım
8	... geçirdiğim vaktin kıymetli olduğunu bilirim
9	Bilim alanında önemli başarılar elde edeceğime inanıyorum
10	... belirlediğim konulara/alanlara yoğunlaşırım
11	... öğrendiğim bilgileri bütün haline getiririm
12	... öğrendiğim bilgileri zihnimde birleştiririm
13	... öğrendiklerimi benim için anlamlı hale getiririm
14	... bildiklerimle öğrendiklerim arasında ilişki kurarım
15	... aldığım notları tekrar incelerim
16	... kendime bir çalışma programı hazırlarım
17	... yardım alabileceğim kişi ve kurumları bilirim
18	... daha kolay öğrenmemi sağlayacak ortamı oluştururum
19	... zamanımı nasıl planlayacağımı bilirim
20	... anlamadığım bir konu üzerinde dururum
21	... karşılaşılabilecek zorluklarla baş ederim

Alt Boyutlar

1. Üst-bilişsel Beceriler : 1., 2., 3., 4., 5., maddeler
2. Motivasyonel Beceriler : 6., 7., 8., 9., 10., maddeler
3. Bilişsel Beceriler: 11., 12., 13., 14., 15., maddeler
4. Yönetimsel Beceriler : 16., 17., 18., 19., 20., 21., maddeler