

## Research Article

# Effects of learning style based differentiated activities on gifted students' creativity

Serkan Demir<sup>1</sup>

Besiktas Science and Art Center for Gifted Students, Istanbul,

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### Abstract

This study aims to investigate how effective are differentiation and enrichment of an instructional design in revealing and improving creative thinking skills of gifted and talented learners. Pre-test and post-test experiment-control group quasi-experimental design was used in this study. The subjects of the study consisted of 72 students aged 10 to 11 years, who were identified as gifted and talented and who are currently attending the same Science and Arts Center (SAC) in the province of Istanbul. When the findings were interpreted, it is possible to conclude that the instructional design that was differentiated and enriched by means of the Kolb's learning styles the Bloom's taxonomy had positive effects on revealing and improving creative thinking skills of gifted and talented learners. Based on the findings obtained within this study, we could recommend that teachers, who would like to support and develop their students' creative thinking skills, should first start with identifying the potentials, interests and learning styles of their students; then provide them with a learning environment where the students can demonstrate their creativity, defend their ideas freely, and produce unique solutions to the problems that they face; and finally employ the approaches, methods, or techniques that improve creative thinking and whose effectiveness is scientifically proven in the literature.

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## Introduction

In the 2013 Strategic and Operational Plan published by the Supreme Council for Science and Technology (SCST), the concept of "giftedness" proposed as a corresponding term to the concept of "superior intelligence" refers to the individuals exhibiting higher levels of performance, compared to their peers, in the fields of intelligence, creativity, art or some other special academic fields (MEB, 2013). When the literature related to the characteristics of the gifted and talented individuals, which is portrayed in that description, is reviewed, it is seen that rapid learning, effective use of numbers, potential of creativity, spatial abilities, problem solving skills, strong memories, advanced moral judgment and sensitivity are among the most common features (Ataman, 1998; Maker and Nielson, 1996; Sak, 2010; Tortop, 2018).

In order to diagnose and develop the aforementioned characteristics of the gifted and talented individuals, it is essential to employ differentiated instruction models such as accelerating, enriching, and grouping, as well as prepare well-designed learning environments (Sak, 2010). The activities should be differentiated and enriched in order to enable gifted and talented learners to progress in their own pace and in accordance with their own abilities and learning experiences.

Differentiation is defined as differentiating the content, process and product dimensions of curriculum by taking the individual differences of the learners (Tortop, 2018). In differentiation, learners are provided with different options of absorbing the information, making sense of it, and expressing what they have learned. In other words, differentiation offers different ways of learning for students while they are working on the content to be learned and interpreting, processing, or producing the information they obtained. In this way, the learners are ensured to learn

<sup>1</sup> Dr., Besiktas Science and Art Center, Istanbul, Turkey. E-mail: [serkandemir4@gmail.com](mailto:serkandemir4@gmail.com) ORCID: 0000-0002-2331-9861

subjects and concepts more effectively by experiencing a variety of ways. On the other hand, enrichment is defined as improving the content related to the themes in the curriculum in line with the needs of the learners as well as maximizing the learning outcomes existing within the curriculum. Enrichment is also characterized as the study of a gifted and talented individual on a subject area in the program, much more intensively and extensively compared to his/her peers. In other words, with the help of enrichment the scope of the curriculum is broadened, and thereby more advanced themes are included. In this way, the students who are high achievers are provided with higher-order skills such as creativity, critical thinking and scientific thinking.

In gifted and talented education (GATE), differentiated instruction usually takes place in the following three dimensions: readiness, learning styles, and interest (attention). Learning styles could be described as the most effective dimensions to facilitate an individual's learning. When the relevant literature is examined, there appear a wide of range of classifications in relation to learning styles. One of the most important classifications is the Kolb's Learning Styles Model, which is also known as Experiential Learning Theory. The experiential learning theory sets out four distinct learning styles as components of an individual's learning. On the basis of those components, Kolb (1984) divides individuals into *Converging*, *Diverging*, *Assimilating*, and *Accommodating* learners.

Individuals with *Converging* learning styles prefer to deal with technical issues. They are successful in problem solving and they do systematic planning while solving the problems. As for learning methods, they prefer techniques such as experimentation, reflective observation, research, and problem solving. Individuals as *Diverging* learners review many aspects of concrete situations and organize relationships in a meaningful way. In the learning process, their thoughts and emotions are of paramount importance. They prefer methods and techniques in which they could use their imagination. Individuals with *Assimilating* learning styles focus on abstract concepts and ideas in their learning process. Their most prominent feature is creating conceptual models. They prefer research, observation and discussion as usual strategies or techniques in the learning process. Individuals as *Accommodating* learners are open-minded in learning situations and able to adapt to everchanging situations easily. Executing the decisions that they make and taking part in new experiences are among their major tendencies. During learning processes, they usually prefer creative writing and reading, brainstorming, and station technique.

### **Purpose and Importance of Research**

In the education of gifted and talented students, teaching environments should be created that will enable students to question different situations and use high level thinking skills, support their independent work, and provide opportunities for them to use skills in different disciplines. In order for this to happen, teachers should configure their learning life by taking into account the characteristics and learning needs of each student in their classroom (Mann, Mann, Strutz, Duncan & Yoon, 2010). Especially identifying individuals' learning styles and providing appropriate educational opportunities according to those styles are important to ensure permanent and effective learning. As depicted in the relevant literature, many studies (Biggs, 2001; Bilgin & Durmuş, 2003; Ekici, 2013; Ghaedi & Jam, 2014; Graf, Kinshuk & Liu, 2009; Güven, 2004; Kaya & Akçin, 2002; Kılıç & Karadeniz, 2004; Ozerem & Akkoyunlu, 2015; Paris & Winograd, 1990; Sutliff & Baldwin, 2001; Vural, 2013) also confirm that a curriculum and learning-teaching processes designed on the basis of learners' learning styles would make it easier for learners to perceive real life events better, make use of learning-teaching processes more efficiently, learn how to use the information they acquire in appropriate conditions, and gain a higher level of motivation. There are different learning styles in the relevant literature. In this study, Kolb learning styles based on experiential learning were used, as it allows students to determine the learning styles as well as the places that need learning and individual development (Yoon, 2000; Kolb, 2000; Whitcomb, 1999).

This study aims to investigate how effective is *differentiated* and *enriched* instruction in revealing and improving creative thinking skills of gifted and talented learners. The instruction implemented within this study was differentiated with the help of the tasks and activities provided to the participants in accordance with the Kolb's learning styles and was enriched through the adjustment of the learning outcomes in the curriculum to the levels of analysis, synthesis, and evaluation in accordance with the Bloom's Taxonomy. When the relevant literature is examined, there are studies on the importance of differentiation and enrichment for the education gifted and talented learners, although there are not enough studies to be applied on the differentiation and enrichment of the course outcomes.

The design, which is prepared for the aforementioned purpose, aims to reveal gifted and talented individuals' creative thinking capacities existing as an innate capability and foster their creative thinking with the help of differentiated and enriched educational activities. With this study, it is thought that differentiation and enrichment concepts for teachers of gifted and talented students will be given to how to use them in the lessons.

## Problem of Study

What is the effect of differentiated activities based on learning style on the creativity of gifted students?

## Method

### Research Design

In this study, pre-test and post-test experiment-control group quasi-experimental design was used. The fact that groups are formed through the similar experimental objects, not randomly, while forming experimental group and control group in a quasi-experimental model makes this model different from experimental model (Karasar, 2009). In this study, the features to be tested were determined in accordance with the purpose of the study, the learning environment was arranged in accordance with the subjects and the lesson, and the application was carried out by considering the students' readiness levels.

### Participants

The subjects of the study consisted of 72 students (36 experimental group, 36 control group) aged 10 to 11 years, who were identified as gifted and talented and who are currently attending the same Science and Arts Center (BİLSEM) in the province of Istanbul. The method of appropriate sampling was used in the study.

As for the learning styles of the gifted and talented students who participated in this study, the average values of the points they obtained from the Kolb's learning styles inventory were calculated and the students' learning styles were identified. The results of the analysis are presented in Table 1.

**Table 1.**

*Participants' Learning Styles by Gender*

Styles	Gender	f	%
Converger	Female	9	25.00
	Male	7	19.44
Assimilator	Female	7	19.44
	Male	5	13.88
Diverger	Female	2	5.55
	Male	2	5.55
Accomodator	Female	2	5.55
	Male	2	5.55

As seen in Table 3, 25% of the female students and 19.44% of the male students reflected *converging* learning styles. While 19.44% of the female students and 13.88% of the male students tended to have *assimilating* learning styles, only 5.55% of both female and male students tended reflected *diverging* and *accommodating* learning styles.

In order to determine the level of creativity of the specially gifted students in the experimental and control group involved in the research, the creativity scale (how creative are you? the t test was used to determine if there was a significant difference between the scores. The results obtained are presented in Table 4.

**Table 2.**

*T-test Results Regarding the Scores Obtained from the Creativity Test*

	N	X	SS	Sd	t	p
Experimental Group	36	54.62	1.26	1.64	-1.68	0.38
Control Group	36	53.27	2.17			

It was determined that there was no significant difference between the scores obtained from the creativity scale of the students in the experimental and control groups ( $t=-1.68$ ;  $p>0.05$ ). In other words, the study concluded that there was no difference between the creativity levels of the students in the experimental and control groups and that they could participate in the practice in both groups.

### Data Collection Tools

The data collection instruments that were used in the study were as follows: the Kolb Learning Styles Inventory (1985); the Creativity Test by Whetton and Cameron (2002); Torrance creative thinking Test Form A (Torrance, 1966) which was adapted by Aslan (2001) to Turkish culture.

### ***The Kolb Learning Styles Inventory***

The translation of the Kolb Learning Styles Inventory into Turkish was performed by [Akkoyunlu and Peter \(1993\)](#) (transmitted by [Genç & Kocaarslan, 2013](#)). The inventory includes 12 items each of which have four options. Each item receives a score of one to four points. The minimum score that can be obtained from the inventory is 12 and the maximum score is 48. It was determined that [Gencel \(2007\)](#) adapted to Turkish and the learning style dimensions of the inventory, whose validity and reliability study was performed, varied between Cronbach Alpha reliability coefficients between 0.71 and 0.80. Total score is obtained from inventory individuals among four that best define their learning styles. The next step is to obtain combined points. The combined scores value ranges from -36 to +36. With the combined scores, scores for the four basic learning styles are created in the learning circle of the student. The combined points represent the learning style of the individual on the x-y axis.

### ***The Creativity Test (How creative are you?)***

In order to determine the difference between the pre-implementation creativity levels of experimental and control groups, the scale named “How creative are you?” that was taken from [Whetton and Cameron \(2002\)](#) was used. Linguistic equivalence in the translation, validity, and reliability of the items within the scale was ensured by [Aksoy \(2004\)](#). The 40 items included in the scale aims to designate the learners’ attitudes towards, interests in, and desires for creativity as well as to identify their creative personalities. On the other hand the 40 question was not in grading scale type. The reliability analysis of the scale indicated the Cronbach Alpha value as 0.78.

### ***Torrance Creative Thinking Test***

In this study, Figural Form A of the Torrance creative thinking test developed by [Torrance \(1966\)](#) and Turkish language equivalence by [Aslan \(2001\)](#) was used to determine the creativity skills of the students in the experimental and control group. Figural Form A consists of three activities: picture creation, picture completion and parallel lines. Torrance Test scores are calculated on the sub dimensions of creativity: fluency, authenticity, detailing and elaboration (abstraction of titles, resistance to closure, control States of creative power). When calculating scoring, these four sub-dimensions are calculated separately and as total points. 3 experts were involved in the scoring process. With regard to the inter-rater reliability of the TTCT, the results of five rater- reliability studies conducted with 2<sup>nd</sup>, 5<sup>th</sup>, and 8<sup>th</sup> graders as well as college level students and a random group of students ranged between .90 and .99 for five subscales except the college level student group which had a coefficient of .78 for the resistance to premature closure subscale ([Torrance, 2008](#)).

### **Data Analysis Process**

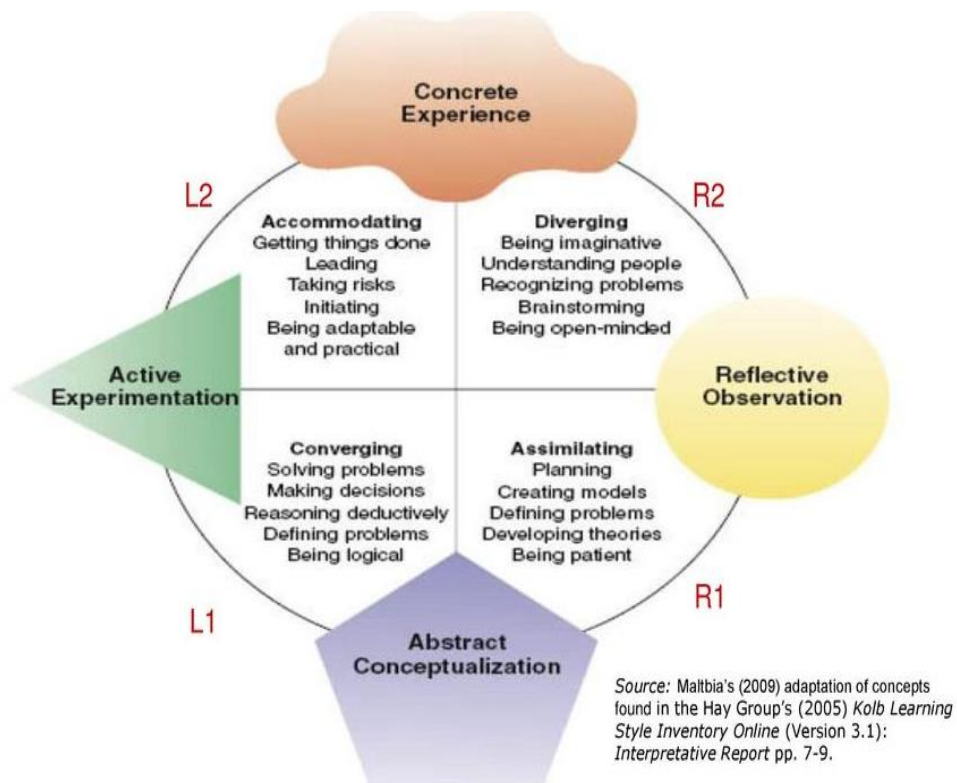
During the analysis of the collected data, one-sample t-test was used and the Levene’s test, mean values ( $\bar{X}$ ), standard deviations (sd), frequency distributions (f), and percentages (%) were calculated.

### **Procedure**

The implementation process took place in a total of 16 weeks between November 2017 and March 2018. Three inventories were employed to determine the characteristics of the participant students before the implementation. To determine the participants’ learning styles, the Kolb’s Learning Styles Inventory was applied and the participants having 4 different learning styles were identified. After the students’ styles were determined, TTCT was implemented.

During the implementation process, students are divided into groups according to their learning styles and the students were assigned tasks in line with their learning styles. In this way, the differentiation is ensured by achieving the same learning outcomes in different ways. In the implementation, along with the high-level learning outcomes, the low-level learning outcomes were adjusted to the higher levels in accordance with the Bloom’s Taxonomy; and thus, the enrichment process was ensured.

During the implementation process, tasks assigned to students are based on the KOLB competency circle created by [Maltbia \(2009\)](#) based on the characteristics of learning paths and learning styles. In the following Figure 1, qualification circle features are presented.



**Figure 1.**  
*KOLB Circle Features*

During the implementation process, the participants completed the tasks in accordance with their own learning styles. In Table 1, the tasks given to the participants were determined on the basis of their learning styles and different approaches, methods and techniques were employed during the implementation process so as to improve creative thinking skills of the participants. The opinions of the groups presented in the table and 2 experts working in Yıldız Technical University, Department of Educational Sciences and 3 teachers working in Science and Art Center were taken.



**Figure 2.**  
*Scenes from Activities*



**Table 3.***Tasks Given to Participants by Learning Style*

<b>Groups</b>	<b>Activities</b>	<b>Details</b>
<b>Common Tasks</b>	Application of the Kolb's Learning Styles Inventory	Participants' learning styles were identified.
	Application of the Creativity Test	It was employed as a pretest –posttest
	Torrance Creative Thinking Test	It was employed as a pretest –posttest
	Semi-Structured Interviews	To identify students' views
	Implementation of the Creative Thinking Activities by J. Renzulli	The creative thinking activities prepared by J. Renzulli were implemented on the basis of the participants' learning styles.
<b>Converging</b>	Authentic Designs for the Science and Technology Learning Outcomes	Machines and robots were designed as a solution to environmental pollution.
	Designs for Mathematics Learning Outcomes	Within the scope of the unit “Currencies” they designed their money by taking references from the models of the coins and banknotes around the world.
	Technology and Enrichment	Creative products were constructed through the programs of Canva, Storybird, Storyboard, Tagul from Web 2.0 tools.
	Engineering Theme and Creativity	An authentic machine was designed as intended for a specific problem in accordance with learning styles. The school of the future was designed.
<b>Diverging</b>	Implementation of the Station Technique	Outcomes were produced in accordance with the method related to the theme so as to reveal their level of creative thinking as a group.
	Game Design	Based on the materials given, original games were designed in groups and the games were played by other groups.
	Implementation of the Drama Technique	Activities were carried out to reveal their level of finding creative solutions that can be proposed to a problem situation as a group.
	Authentic Designs for the Visual Arts Learning Outcomes	Authentic products in relation to Visual Arts learning outcomes were designed.
<b>Assimilating</b>	Implementation of the Six Thinking Hat Technique	In order to reveal various thinking skills, different ideas about the theme were put forward.
	Implementation of the RAFT Technique	Through RAFT, which is a differentiated instruction technique, the participants performed the tasks that are appropriate to their own styles.
	Creative Reading for Turkish Language Learning	They performed tasks that are suitable for their learning styles with the help of the Reading Circles method.
	Social Studies Learning Outcomes and Creative Problem Solving	Solutions were generated in relation to specific social problems by means of the creative problem-solving technique.
<b>Accommodating</b>	Implementation of the Station Technique	Outcomes were produced in accordance with the method related to the theme so as to reveal their level of creative thinking as a group.
	Creative Reading Activity	Stories were written in in compliance with grammatical rules. They constructed their own alphabet with the help of the Cryptology Technique.
	Boxs Game Design	Based on the materials given, original box games were designed in groups and the games were played by other groups.
	Original Designs	As for the world of living creatures, new species were designed taking references from the features of the already existing species.

## Results

### Effect of Gifted Students' Creativity

The creativity of the gifted students study six dimensions of fluency, originality, elaboration, abstractness of titles, resistance to premature closure, creative strengths in order to determine their level of pre-test and Torrance creativity test was used as a contest to determine whether there is a significant difference between the scores of the effects obtained from a T test was applied. The scores obtained by the students in the experimental group are presented in Table 4 and the scores obtained by the control group Students are presented in Table 5.

**Table 4.**

*t-Test Results Of Experimental of Torrance Creativity Test Score*

Dimensions	Test	N	$\bar{X}$	S	t	p
Fluency	Pre-test	36	13.86	2.97	-11.31	0.00*
	Post-test	36	20.63	2.66		
Originality	Pre-test	36	14.83	3.70	-6.31	0.00*
	Post-test	36	20.78	5.08		
Elaboration	Pre-test	36	14.31	2.64	-6.36	0.00*
	Post-test	36	20.72	1.56		
Abstractness of Titles	Pre-test	36	12.13	2.24	-16.74	0.01*
	Post-test	36	18.72	1.57		
Resistance to premature closure	Pre-test	36	12.52	2.46	-17.71	0.01*
	Post-test	36	19.94	1.49		
Creative strengths	Pre-test	36	9.80	1.57	-20.67	0.00*
	Post-test	36	15.48	2.64		

As shown in Table 4, the Torrance Test of the students in the experimental group was determined by the fluency ( $t = -11.31$ ,  $p < .05$ ), originality ( $t = -6.31$ ,  $p < .05$ ), abstraction of titles ( $t = -16.75$ ,  $p < .05$ ), resistance to premature closure ( $t = -17.71$ ,  $p < .05$ ), creative strengths ( $t = -20.67$ ,  $p < .05$ ) sub-dimensions' pre-test post-test scores were found to be statistically significant. In other words, it was concluded that the application had a positive effect on the creativity levels of the students.

**Table 5.**

*t-Test Results of Control Group of Torrance Creativity Test Score*

Dimensions	Test	N	$\bar{X}$	S	t	p
Fluency	Pre-test	36	12.75	2.74	-3.22	0.38
	Post-test	36	13.24	4.68		
Originality	Pre-test	36	12.74	3.74	-2.04	0.21
	Post-test	36	13.38	3.98		
Elaboration	Pre-test	36	13.36	2.14	-3.63	0.38
	Post-test	36	15.53	3.57		
Abstractness of Titles	Pre-test	36	10.97	2.55	-3.43	0.32
	Post-test	36	11.52	2.14		
Resistance to premature closure	Pre-test	36	11.94	2.19	-3.38	0.20
	Post-test	36	12.36	2.08		
Creative strengths	Pre-test	36	10.19	1.97	-3.24	0.19
	Post-test	36	11.74	2.30		

As shown in Table 5, the Torrance Test of the students in the control group was determined by the fluency ( $t = -3.22$ ,  $p > .05$ ), originality ( $t = -2.04$ ,  $p > .05$ ), elaboration ( $t = -3.63$ ,  $p > .05$ ), abstraction of the titles ( $t = -3.43$ ,  $p > .05$ ), resistance to early closure ( $t = -3.38$ ,  $p > .05$ ), creative strengths ( $t = -3.24$ ,  $p > .05$ ) the difference was not statistically significant.

## Discussion and Conclusions

When the findings emerging in the current study were interpreted, we could conclude that the instructional design that was differentiated and enriched according to the Kolb's learning styles had positive effects on revealing and developing creative thinking skills of gifted and talented learners. The finding that the creative thinking can be improved when the learning and teaching processes are arranged in accordance with the learning styles of the students

is also consistent with the findings of the studies conducted by Chapman (1997) and Scott, Lenitz and Mumdorf (2004).

Tomlinson (2000) argues that the educational environment should be differentiated for gifted and talented learners. His statements about the reasons for this proposition are as follows: 1) The readiness level, interests and learning styles of the learners might differ even within the same class. In particular, gifted and talented children are in need of different levels of content and acceleration. 2) Gifted and talented learners might need to be challenged to show higher performance on the subjects that they have acquired. 3) Gifted and talented learners need to associate what they have learned in the school with their daily life. In other words, they need an enriched, challenging and well-designed learning environment for the themes included in the curriculum. After all, they need differentiated and enriched instructional designs that provide authentic research opportunities, as a starting point, for the problems regarding everyday life; ensure the use of scientific knowledge in solving those problems; and support higher-order thinking, interdisciplinary associations and creative productivity (Cooper, Baum & Neu, 2004; Güven, 2004; Meador, 2003; Maker & Nielson, 1996; Sak, 2010; Tomlinson 2000). The results of those attempts could be implied as indicators of the occurrence of significant changes observed in their learning processes going through differentiated and enriched instruction; use of skills for scientific processes; attitudes towards the classes; getting pleasure out of the classes, and so on.

One of the aims of education is to educate individuals who are constantly thinking, transferring their ideas into the real life, and producing new solutions to the problems they encounter. Raising individuals in line with this goal is mostly possible with their being aware of their own cognitive processes. Therefore, it is important for individuals to get to know their own learning styles. Individuals who are aware of their own learning can be successful in both academic and social life (Güven, 2004). In this study, the students were enabled to realize their own learning styles and to perform the tasks that are appropriate to their learning styles. For example, since the students having the “*Converging*” style of learning, as one of the Kolb’s learning styles, are more willing and successful in working on technical issues, they were given tasks such as machine design, game design, spacecraft design, or design of the future school; and by this way, it is aimed to develop their creative thinking skills. In this process, the students participating in the research performed their tasks according to their learning styles and developed their creative thinking skills.

The positive impact of designing a learning environment suitable for learning characteristics on students’ thinking skills have been put forward by several previous studies. For instance, the study conducted by Aktamiş and Ergin (2006) emphasized that the students having creative potentials need a supportive environment that endorse both the product and the process; all children come to the world with the potential for creativity; and their school life is supposed to allow them to make discoveries through creative thinking, to look into the events and situations from different perspectives, and to produce new solutions to the problems they face in their daily lives.

Creativity levels need to be developed in order for students to grow up as individuals who can solve problems about themselves and their immediate surroundings as well as to look into the events from different perspectives. To do this, as given in the activities implemented within the scope of this study, it would be more effective, to find solutions to a real-life problem or improve their imagination in accordance with their learning styles. In addition, teachers can develop creative thinking skills in such a classroom setting where the teacher is a democratic and respectful guide; the students learn by doing and through lived experiences; different thinking skills are used and in-class interaction is engaged; and there is a positive atmosphere for discussion and inquiry. That classroom setting is also supposed to be environmentally friendly. According to Özerbaş (2011), a teacher who wants to improve the creativity of his/her students should firstly prepare a comfortable learning environment in which the students enjoy and learn as well as express their feelings and thoughts freely. In addition, he claimed that a curriculum which is designed within the vision of progressive education; which is based on interests and developmental characteristics of students; which attaches importance to the research and problem-solving skills of the students; and which gives priority to the student decisions would definitely make a positive impact on the creativity of the students. Başer and Ersoy (2009) argue that teachers should include activities that will motivate students within the classroom and that will enable students to make authentic experiments. They should also prepare learning-teaching environments that will enable students to find different solutions to the problems encountered in real life.

Based on the findings of the current research, it could be recommended that teachers, who would like to support and develop their students’ creative thinking skills, should first start with identifying the potentials, interests and learning styles of their students; provide them with a learning environment where the students can demonstrate their creativity, defend their ideas freely, and produce unique solutions to the problems that they face; and employ the



approaches, methods and techniques which develop creative thinking and whose effectiveness is scientifically proven in the literature.

### Limitations of Study

In this study, the necessity of applying and evaluating the Torrance Creativity Test correctly is seen as the limitation of the study. In this context, the limitation was reduced by the researcher taking Torrance Test Practitioner Training.

### Biodata of Authors



Dr. Serkan DEMİR, was born in Malatya, 1978. Author received a classroom school teacher degree in 2002, and completed her master's and doctoral studies in the field of Education Programs and Teaching at Yıldız Technical University. Since 2015, he has worked as a classroom teacher at Beşiktaş Science and Art Center, where gifted students are educated. **E-mail:** serkandemir4@gmail.com **ORCID:** 0000-0002-2331-9861

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