



The Relationship between Creative Thinking and Critical Thinking Skills of Students

Öğrencilerin Yaratıcı Düşünme ve Eleştirel Düşünme Becerileri Arasındaki İlişki

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ABSTRACT: This study aimed to determine the relationship between creative thinking and critical thinking skills of students. Participating university students ($N= 174$) during the 2012 fall semester had a mean age of 21.74 years. The data were obtained using the California Critical Thinking Disposition Inventory and the Torrance Test of Creative Thinking. A quantitative research method was used for collection, analysis and interpretation of data. According to the results, there was a significant positive correlation between creative thinking and critical thinking skills of students in the low level. The strength of this correlation varied from medium to significant in the Visual Arts Education and Religion & Ethics Education departments; however, it was not significant in Mathematics Education or Preschool Education departments. Accordingly, it can be concluded that the significant relationship between creative and critical thinking of students pursuing degrees within the departments of Visual Arts or Religion & Ethics Education originates from the tendency of these students to use non-routine problem solving processes resulting from the nature of their learning climate and educational outcomes. Thus, it can be put forward that the use of non-routine problem solving processes plays a vital role in the significant correlation between creative thinking and critical thinking skills of students.

Keywords: Creativity, creative thinking, critical thinking, non-routine problem solving

ÖZ: Bu araştırmanın amacı öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasındaki ilişkiyi belirlemektir. Bu amaçla, 2012-2013 öğretim yılının güz döneminde 174 üniversite öğrencisine (yaş ort: 21.74) Torrance Yaratıcı Düşünme Testi ve California Eleştirel Düşünme Eğilimi Ölçeği uygulanmıştır. Araştırma, nicel yöntemlerden ilişkisel tarama modelindedir. Araştırmadan elde edilen bulgulara göre, öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasında olumlu yönde, düşük düzeyde anlamlı bir ilişki bulunmuştur. Mevcut bulunan ilişki düzeyi öğrencilerin öğrenim gördükleri bölüme göre ise değişmektedir. Resim İş Eğitimi ve Din Kültürü ve Ahlak Bilgisi Eğitimi bölüm öğrencilerinin yaratıcı düşünme ve eleştirel düşünme becerileri arasındaki ilişki orta düzeyde anlamlı iken, Okul Öncesi Eğitimi ve Matematik eğitimi bölüm öğrencilerinin aynı türden ilişki düzeyi düşük ve anlamlı değildir. Bu sonucun nedeni olarak, Resim İş Eğitimi ve Din Kültürü ve Ahlak Bilgisi Eğitimi bölüm öğrencilerinin öğrenme – öğretme ikliminin doğal çevresinden kaynaklanan rutin dışı problemlerle karşılaşma sıklığı görülmüştür. Buna göre, rutin dışı problem çözmeye duyarlılık yaratıcı düşünme ve eleştirel düşünme becerisinin ortak özelliği olmasından başka iki düşünme biçimi arasındaki anlamlı ilişkide de önemli bir rol oynadığı sonucuna varılmıştır.

Anahtar sözcükler: Yaratıcılık, yaratıcı düşünme, eleştirel düşünme, rutin dışı problem çözme

1. INTRODUCTION

Rapid changes in the world today accompany the rapid development of technology. As a result, we increase the possibility of running into problems in our daily lives that lack previously determined solutions, which defines them as non-routine problems. As Lubart (2001) stated, the routine problem solving tends to search for ready-made solutions related with convergent thinking. Whereas, new problems lead to the development of new mechanisms (Siegler, 1989) as multiple cycles of divergent and convergent thoughts (Lubart, 2001). Thus, these problems include more creativity in solving process than routine problems (Mumford, Mobley, Reiter-Palmon, Uhlman and Doares, 1991). Therefore, the solving processes of the novel problems do

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not involve routine evaluations (English, 1996) as non-routine problems. With referring to researchers, Pantziara, Gagatsis and Pitta-Pantazi (2004) stated that non routine problems do not involve routine computations during solving process. These non-routine problems are similar to ill-defined problems which are not like problems encountering in schools or on a test (Runco, 2014) and they frequently lead creative efforts for solutions (Runco, 1994). Accordingly, the problems can be characterized as academic (well-defined) and the real world (ill-defined) generally (Statistics Canada & OECD, 2005). These real-life problems require reasonable decisions in the face of crucial uncertainties (Paul, 1990). Furthermore, such problems demand a high level of creativity (Cropley, 2001). For problems of this type, it is necessary to use thinking skills in order to find a solution. As Synder (1993) stated that critical thinking skill uses logical/analytical and intuitive/creative approaches for solving these problems.

Nosich (1994) theorized that critical thinking requires more than higher order thinking skills. According to definitions of *Critical thinking* is also including many traits of higher order thinking skills that is focused on logical decision-making, acquiring and assessing information (Demirel, 2012; Ennis, 1981; O'Hare and McGuinness, 2004; Schafersman, 1991) and problem solving (Chance, 1986; Halpern, 1996). Similarly, Kennedy, Fisher and Enis (1991) stated that critical thinking skills entail the ability to identify and focus on a problem in order to understand and judge the validity and consistency of the hypothesis and information.

Creative thinking is considered the ability to produce original ideas or answers (Duff, Kurczek, Rubin, Cohen and Tranel, 2013) and to perceive new and unsuspected relationships or unrelated factors (Piawa, 2010). Cropley (2001) stated that creativity is finding new ways regard unusual correlations or solutions. Mumford (2003) noted that identifying and defining problems is an important influence on creative performance. Guilford and Hoepfner (1971) stated that creative people are sensitive to the existence of problems and that individuals have few opportunities to demonstrate creative traits without the existence of problems to solve. Although Runco (2007) confirmed that creativity is very helpful for solving problems, he believes that creativity has other purposes, as well. Lemon (2011) also noted that creativity is a multifaceted trait. Several researchers report that recognizing, finding and being aware of problems are predominantly trait of creativity (e.g. Cropley, 2001).

Creative thinking and critical thinking no doubt involve many traits. Piawa (2010) reported on studies that reveal the traits of creative thinking and critical thinking based on theories that have been accepted by researchers. These traits are as follows: *Creative thinking* produces ideas; enables a dissimilar point of view; is imaginative; has the potential to produce advanced ideas and changes; is able to produce advanced ideas and changes; is able to produce many ideas; likes to fantasize; tends to immediately view a problem from multiple perspectives; is skilled in extending and breaking the borders of the problem. *Critical Thinking*; evaluates ideas; is assessment the validity of facts before making decisions; is logical; search for the quantity of fact of issue; determines rules and criteria in the thinking process; is skill in asking questions and defining problems; seeks the most appropriate way to solve a problem. By and large, the traits of both thinking abilities include new perspectives instead of being tied down to rules or only looking to the ordinary and unoriginal. The analysis, assessment, decision-making and logical problem solving are necessary traits for critical thinking. For creative thinking; imaginative, produce original ideas and finding new solutions to problems are necessary traits. Creative thinking tends to produce original ideas, views and perspectives for solving problems, and critical thinking tends to produce logical ideas, views and perspectives for solving problems.

From these traits, it can be said that creative thinking and critical thinking are strengthened as individuals become sensitive to problems and produce ideas. As Seferoğlu and Akbıyık (2006) emphasized that the common point in the definitions of critical thinking and creative thinking is problem solving. In particular non routine problem solving originally and logically can be seen as

a foremost common trait of creative thinking and critical thinking. At this point, the critical thinking is not different from the creative thinking as thinking activities in cognitive process of human brain (Burke and Williams, 2008). The ideal critical thinker is usually inquisitive, well-informed, trustful of reason, open-minded, fair-minded in evaluation, honest in facing personal biases, prudent in making judgments, clear about issues, orderly in complex matters, diligent in seeking relevant information, reasonable in the selection of criteria, focused in inquiry, and persistent in seeking results which are as accurate as the subject and the circumstances of query allowance (Facione, 1990). However, critical thinking disposition also refers to the trait such as *open-mindedness* that reflect person's inclination to apply critical thinking skills (Renaud and Murray, 2008) and it also demonstrates the understanding of others' views (Aizikovitsh-Udi and Amit, 2011). Beside the 'open-mindedness', the critical thinking dispositions are consisting of *inquisitiveness* that shows how interested the individual is to become and stay well-informed; *self-confidence* that refers to the individual's own ability regarding his/her confidence; *truth seeking* that shows flexibility in alternatives and views; *systematicity* that shows how careful the individual searches appropriate information; *analyticity* that displays how insistent the individual is in the light of difficulties faced (Aizikovitsh-Udi and Amit, 2011). Also, the 'analyticity' subscale of critical thinking disposition measures for reasoning and the use of proof to resolve problems. However, the 'open-mindedness' subscale refers to be tolerant of divergent opinions with sensitivity to the probability of one's own bias as well. The 'inquisitiveness' subscale measures of one's intellectual inquisitiveness with desire for learning, even if knowledge is not obvious. The 'self-confidence' subscale addresses the trust one's own reasoning processes with allowing one to lead others in the resolution of problems. The 'truth-seeking' subscale aims the disposition of seeking the best knowledge about problems and objective about pursuing inquiry, even if the findings do not support the preconceived opinions. The 'systematicity' subscale measures the leaning toward organized, focused, and diligent inquiry (Facione, Facione and Sanchez, 1994).

On the other hand, Wu, Wu, Chen, and Chen (2014) stated that major characteristics of creativity were the imagination, openness to experience, inquisitiveness / curiosity, intuition, idea-finding, tolerance for ambiguity, independence, innovation, insight, internal / external openness, illumination / insight, problem-finding, and imagery. Ideation as fluency and originality can be only maximized for students who have the opportunity to think divergently (Runco, 2003). However, creativity has been defined as more than just divergent thinking. For instance, scholars described that creative thinking were fluency; sensitivity to problems; originality; the ability to analyze, synthesize and redefine problems and organize logically (Bonk and Smith, 1998). Hence, prominent researchers have suggested that educational efforts must include critical thinking and evaluative skills for divergent thinking to recognize and explore original ideas. That is, divergent thinking and evaluative thinking or judgmental thinking as critical thinking must work collectively for true creative thinking (Runco, 2003). Based on researches, Bonk and Smith (1998) stated that critical thinking is the ability to make judgment in complex real world situations to examine any belief or supposed form of knowledge in the light of evidence. Feldhusen and Goh (1995) stated that creativity includes cognitive activities such as critical thinking. Also, Critical Thinking has been considered together with creative thinking as related subordinate concept in productive thinking (Renaud and Murray, 2008).

However, some theorists believed that creative thinking and critical thinking were unrelated, in contrast to that, others emphasized that there was a relation between both thinking skills (Chang, Bei-Di Li, Chen, and Chiu, 2015). Already, it has been started to think that the gap between creative thinking and critical thinking has been narrowed by development of integrated theories in terms of creative thinking of 'reflective' and 'non-reflective' parts. The 'Reflective' creative thinking encounters with critical thinking when a person consciously proposed the hypothesis to the question. Hence, many researchers believe that critical thinking as a process of

problem solving includes creative thinking (Chang et al., 2015). At this point, Yang and Lin (2004) based on thoughts of prominent researchers stated that critical thinking involves not only logical, but it also involves creative aspects. Even, creative thinking development of a student increases along with development of critical thinking just like interactively (Chang et al., 2015). However, Runco (2014) stated that so few investigations have assessed the critical and evaluative components of creativity as a disappointing topic. According to him, we really need to examine the interaction between creative thinking with critical thinking, evaluative thinking (Runco, 2003), but this issue is not often studied (Runco and Chand, 1994).

1.1. Purpose of the study

Although creative thinking and critical thinking include many common traits as problem solving, there is very little research to determine the relationship between both thinking skills and little is known about this relationship. Therefore, the aim of this study was to determine the relationship between creative thinking and critical thinking skills. For this purpose, it was investigated university students' creative thinking and critical thinking skills with including subscales of these thinking skills. Students as participants were pursuing a degrees in the departments of Visual Arts Education, Religion & Ethics Education, Mathematics Education and Preschool Education. From this analysis, answers to the research questions below were answered. Research questions were as follows:

- 1- Is there a significant correlation between creative thinking and critical thinking skills of students?
- 2- Does the strength of this correlation level between creative thinking and critical thinking skills of students based on the degree pursued differ?

2. METHOD

2.1. Participants

In this study, it was given great importance to participate different education departments in the variety from Visual Arts Education toward Mathematics Education in this study in terms of providing the diversity of participants at the point of the Education Departments. As considering this point, education departments were randomly selected in this study giving great importance to be variety of education departments. Thus, the diversity of participants was provided. Accordingly, the students of Visual Arts Education, Religion & Ethics Education, Mathematics Education and Preschool Education Departments participated to the study. A quantitative research method was implemented in this study. Participants had a mean age of 21.74 years and were students (N: 174; 63 male and 111 female) in their fifth semester of study for an undergraduate degree. The students were pursuing a degree within the department of Visual Arts Education (N: 31; 17%), Religion & Ethics Education (N: 62; 35%), Mathematics Education (N: 40; 22%) and Preschool Education (N: 41; 25%) at Cumhuriyet University in Turkey during the fall of 2012 semester. Participants completed the *Torrance Test of Creative Thinking* (30 min) and the *California Critical Thinking Disposition Inventory* (approximately 35 min) as groups of 31 to 62.

2.2. Instruments

Two measurement tools were employed: the *Torrance Test of Creative Thinking* (TTCT) and the *California Critical Thinking Disposition Inventory* (CCTDI). The TTCT, used to measure the creative thinking of individuals, was developed by E.P. Torrance in 1966, it is the most frequently used method for measuring creative thinking worldwide, and it has been translated into more than 35 languages (Lemon, 2011). The TTCT method has not been changed since 1966; however, the scoring procedures were revised in 1984 in the third edition of the TTCT manual.

For this study, the most recent revision (1984) was used for scoring. The best known test is the TTCT based on divergent thinking (Cropley, 2001). Individual's creative thinking abilities can be revealed with his/her divergent thinking abilities. Hence, TTCT includes test activities in accordance with Guilford's divergent thinking factors as Fluency, Originality and Elaboration (Torrance, 1966). Also, sub dimensions of TTCT as Abstractness of Titles, Closure and Creative strengths were added later manual measurement to reveal of creativity phenomena besides fluency, originality and elaboration subscales. Thus, it can be said that TTCT is the most appropriate test among the creative thinking tests in terms of containing large scope and variety of creative thinking sub dimensions. The TTCT includes scores for fluency, originality, elaboration, abstractness of titles (titles), resistance to premature closure (closure) and 13 creative strengths (strengths) subscales. The 1984 revision of TTCT was adapted into Turkish by Aslan (2001), who performed reliability and validity studies for the Turkish version.

CCTDI, a project created based on an APA Delphi report, was created by the leader of the American Philosophical Association to assess an individual's level of critical thinking ability (Facione, Facione & Giancarlo, 1998). As a growing consensus among critical thinkers is that the critical thinking must include nurturing disposition of critical thinking. Accordingly, some habits of ideal critical thinker were determined as inquisitive, open-minded and prudent in making judgments (Facione, Sánchez, Facione, and Gainen, 1995). Thus, critical thinking disposition are embedded into the basic elements of critical thinking (Ennis, 1996). The CCTDI was developed to measure these dispositional components of critical thinking (Facione, Facione, and Sanchez, 1994). In terms of measuring of critical thinking disposition, CCTDI is thought as a suitable tool in terms of including large variety of sub dimensions as *analyticity*, *open mindedness*, *inquisitiveness*, *self-confidence*, *truth-seeking* and *systematicity* sub-dispositions.

The original English CCTDI was translated into Turkish by English language experts, psychologists and Kökdemir (2003), who then administered the translated CCTDI to 913 university students. According to the results of their analyses, the Turkish version of CCTDI was found to be represented by 51 items. Thus, the CCTDI was adapted into Turkish with subscales of analyticity, open mindedness, inquisitiveness, self-confidence, truth-seeking and systematicity.

2.3. Procedure

The test was conducted for each group as the department of Visual Arts Education, Religion & Ethics Education, Mathematics Education, and Preschool Education separately, within a week. The administration of data collection procedure was implemented for each group in accordance with the test guidelines similarly. The tests were implemented all the groups by author to minimize the effects of different administration.

3. FINDINGS

3.1. Correlations

In this study, 174 TTCT and CCTDI test forms were collected, from which statistical analyses were completed. Pearson's Correlation Coefficient was computed to determine the correlation between creative thinking and critical thinking scores of students. The result of the correlation analysis is presented in Table 1.

Table 1: Correlations between creative thinking and critical thinking disposition

Measurements	N	Correlation Coefficient (r)	Strength of Correlation		
TTCT CCTDI	174	.24**	Low*	Medium	High

** $p < .01$ * $r = .00 / .30$ **Table 2: Subscales correlations between creative thinking and critical thinking disposition**

	Fluency	Originality	Titles	Elaboration	Closure	Strengths
Analyticity	.14	.08	-.01	.21**	.21**	.20**
Open Mindedness	.07	.04	-.06	.14	-.05	.18*
Inquisitiveness	.10	-.05	-.01	.08	.13	.16*
Self-Confidence	.06	.02	.07	.10	.11	.09
Truth-Seeking	.12	.13	-.06	.18*	.10	.23**
Sistematicity	.07	-.03	-.03	.05	.02	.01

* $p < .05$ ** $p < .01$

According to the results presented in Table 1, there is a significant positive correlation between creative thinking and critical thinking disposition scores of students ($r = .24, p < .01$). This correlation indicates that critical thinking positively affects creative thinking in low levels. Coefficient of determination is square of correlation which is a positive value between .00 and 1.00 (Akin, n.d.). The r^2 is based on the proportion of variability of the study variable (Chenga, Shalabh, and Garg, 2014). The correlation coefficient was computed to be $r^2 = .06$. Thus, the 6% variance in critical thinking disposition originates from creative thinking. One could hypothesize that this variance relation is also valid for the other variable.

The correlations between the subscales of creative thinking and critical thinking disposition scores were also computed. From the results, significant positive and low level correlations were found for various subscales between creative thinking and critical thinking dispositions (see Table 2). These are as follows:

Relationships were found between *Analyticity* (a subscale of critical thinking) and *Creative Strengths*, *Elaboration* and *Resistance to Premature Closure* (subscales of creative thinking) respectively. The other relationships were found between *Creative Strengths* (a subscale of creative thinking) and *Open Mindedness*, *Inquisitiveness* and *Truth-Seeking* (subscales of critical thinking) respectively. Also relationships were found between *Elaboration* (a subscale of creative thinking) and *Truth-Seeking* (a subscale of critical thinking).

The data were also examined using correlation analysis to determine whether there was a significant difference in the strength of the relationship between creative thinking and critical thinking of students based on their education departments. The correlation between creative thinking and critical thinking disposition scores disaggregated by educational department was examined using Pearson's Correlation Coefficient (r). This coefficient, calculated for two variables, is defined as high when it takes on a value from .70 - 1.00, medium from .50 - .70 and low from .30 - .50 (Büyüköztürk, 2003). The results are presented in Table 3 show that the correlation between creative thinking and critical thinking disposition scores to be medium and significant for students in the departments of Visual Arts Education or Religion & Ethics Education. This correlation was not significant, however, for students in the departments of Mathematics Education or Preschool Education. Hence, the strength of the correlation between creative thinking and critical thinking dispositions differs for students based on their educational department.

Table 3: Pearson's correlation level of the relationship between creative thinking and critical thinking disposition scores of students disaggregated by educational department

Education Dept.	N	Correlation Coefficient	Strength of Correlation		
		(r)	Low	Medium	High
Visual Arts	31	.32*	-	.30 - .70	-
Mathematics	40	.16	.00 - .30	-	-
Preschool	41	.09	.00 - .30	-	-
Religion & Ethics	62	.35**	-	.30 - .70	-

* $p < .05$ ** $p < .01$

4. DISCUSSION and RESULTS

Empirical research verifies that critical thinking engages cognitive skills and dispositions (Shamala, 2011). Yang and Chou (2008) also found a positive relationship between critical thinking skills and critical thinking dispositions. Taube (1995) reported that critical thinking can be conceived of as having two-components: critical thinking abilities and critical thinking dispositions. Branch (2000) listed subscales of CCTDI to indicate individuals who use critical thinking. Thus, it can be considered that critical thinking is also includes disposition. Accordingly, critical thinking dispositions will be referred to as critical thinking in this section.

The results of this study show a significant relationship between creative thinking and critical thinking of students. This result is supported by Murphy (1999), who found a significant relationship between creative thinking and critical thinking among undergraduate nursing students. Gök and Erdoğan (2011), who investigated the relationship between creative thinking and critical thinking dispositions of teacher candidates, found a significant relationship between the two. From the results presented here, it can be said that creative thinking and critical thinking affect each other significantly in the low level. To investigate the cause of this result, details relating the subscales of creative thinking and critical thinking were considered.

A significant relationship was found between *Analyticity* (a subscale of critical thinking) and *Creative Strengths, Elaboration* and *Resistance to Premature Closure* (subscales of creative thinking).

The relationship between *Analyticity* and *Creative Strengths*

The Analyticity is defined to be the tendency to be sensitive to recognizing problems (Kökdemir, 2003). Creative Strengths include emotional expression, articulate storytelling, movement and action, expressiveness of titles, synthesis of incomplete figures, synthesis of lines or circles, unusual visualization, internal visualization, extending or breaking boundaries, richness of imagery, colorfulness of imagery and fantasy (Aslan and Puccio, 2006). Torrance (1965) indicates that creativity is the sensitivity toward identifying problems and the development of assumptions for a solution. Creative Strengths as a subscale of creative thinking cannot be thought of an insensitivity to problem solving. The tendency to be sensitive to recognizing problems is meaningful in terms of problem analysis and problem solving.

Hence, the relationship between *Analyticity* and *Creative Strengths* is meaningful through problem solving. According to Paul (1992) critically and creativity have a close relationship with the ability to figure out the problems. Unless having critical thinking, very few students can achieve appropriate reasoning in order to reach solutions for new problems (Mckendree, Small and Steinning, 2002). These new problems as non-routine problems are vital for the creative thinking. Because new problems require open targets (Runco, 1994) that lead to divergent thinking (Urban, 1995) as an aspect of the creative thinking. Hence, present result indicates that creative thinking correlate with the critical thinking in the context of the problem solving

mutually in terms of the Analyticity and Creative Strengths subscales. As Glassner and Schwarz (2007) stated, there is interesting interaction between critical and creative thinking when individuals need to solve difficult problems, thus, one of the possible explanation of this relationship between critical and creative thinking is analytic and divergent regarding critical and creative thinking respectively. Particularly, the relationship between creative thinking and critical thinking comes forward for solution of non-routine problems due to both thinking involves seeking alternatives solution ways.

The relationship between *Analyticity* and *Elaboration*

The Elaboration score assesses the ability to improve, embellish and accomplish the elaborate ideas of individual (Torrance, 1966). Elaboration refers to an ability to embellish and add details to an idea (e.g. Lemon, 2011; Aslan and Puccio, 2006). The analyticity subscale of critical thinking disposition gauges for the use of proof to resolve problems through reasoning. (Facione, et al., 1994). Analyticity is related to problem recognition. This relationship can be explained by seeing that recognition of a problem is first required to see and add details to it. Creative thinking and critical thinking involves seeking alternatives solution ways considering the details of problems. Especially, it can be thought that the seeking out alternatives solution ways for non-routine problem is key feature for the relationship between creative and critical thinking interactions of Analyticity and Elaboration.

The relationship between *Analyticity* and *Resistance to Premature Closure*

Resistance to Premature Closure is an individuals' ability to be intellectually probing and to remain open-minded (Kim, 2011). Open-minded is inclination that is contemplating new proof beside a favored belief through spending necessary time on a problem (Haran, Ritov, and Mellers, 2013). This inclination is possible via tolerance of uncertainty. For that, novel solutions can be utilized to remain the openness (Feldhusen and Goh, 1995). In this manner, the Closure can help to remain open to uncertainty (Cha'vez-Eakle, Eakle, and Cruz-Fuentes, 2012). According to Basadur (1994) individuals have hardship to maintain the uncertainty because of they are traditionally taught to be each problem has either one right answer or wrong logically. Hence, the uncertainty can be provided for students by the Closure owing to be away from to give correct answer as *yes* or *no*. Accordingly, students can possess uncertainty in this way. In this situation, the Analyticity can meet with the Closure in the problem solving process. At this point, it can be said that Resistance to Premature Closure should be probing for problem recognition in every angle. Considering that Analyticity is also the tendency for sensitivity toward recognition and reasoning the problems, the relationship between these two subscales is meaningful regarding problem analysis.

In terms of analyticity subscale correlated with Creative Strengths, Elaboration and Resistance to Premature Closure, it can be said that analyticity is major critical thinking subscale to interact with the creative thinking. This result is also supported by Wu, et al. (2014) who found that the analytical process, is significant factor for students' creative thinking development. As one of the reasons of this result, it can be shown that is the uncertainty commonly feeding from critical thinking and creative thinking in non-routine problem solving process.

A significant relationship was also found between *Creative Strengths* (a subscale of creative thinking) and *Open Mindedness, Inquisitiveness and Truth-Seeking* (subscales of critical thinking).

The relationship between *Creative Strengths* and *Open Mindedness*

We know that Creative Strengths is related to problem identification sensitivity and the development of assumptions for a solution. Open Mindedness is a tolerance for different approaches and a willingness to make mistakes (Kökdemir, 2003). Accordingly, in the context of

problem solving it can be said that the construction of different hypotheses and the development of multiple assumptions require a tolerance to different approaches and openness toward making mistakes, a possible explanation for the significant correlation between these subscales.

The relationship between *Creative Strengths* and *Inquisitiveness*

Inquisitiveness is a reflection of the nature of finding out new issues (Kökdemir, 2003). This definition implies sensitivity for problem identification and finding solutions, which is also a component of Creative Strengths. This is a possible explanation for the significant correlation between these two subscales.

The relationship between *Creative Strengths* and *Truth-Seeking*

Truth-Seeking is an objective assessment of alternatives or thoughts (Kökdemir, 2003). Alternative ways or thoughts come to fore when individuals encounter a difficulty or problem. Thus, the significant correlation between these two subscales is meaningful because they both impact how solutions to problems are discovered. Another finding of this study was a significant relationship between *Elaboration* (a subscale of creative thinking) and *Truth-Seeking* (a subscale of critical thinking).

On the other hand, Based on Kirton's (1976, 1978, 1987, 1989) adaptor–innovator theory, Fluency and Originality are innovative: The Elaboration and Titles are adaptive (Kim, 2006). Kim (2006) stated that factor models of TTCT were better fit without Creative Strengths than those with Creative Strengths regarding adaptive factor. In present study, it was found that Creative Strengths had more relationships among the creative thinking subscales correlating with Open Mindedness, Inquisitiveness, Truth-Seeking, and Analyticity. Under the present result, Creative Strengths correlated with Open Mindedness, Inquisitiveness, Analyticity and Truth-Seeking. According to Wu, et al. (2014) these subscale are major characteristics of creativity as to be openness to experience, inquisitiveness and curiosity. At this point, Glassner and Schwarz (2007) stated that creativity is necessary for all rational thinking as critical thinking. Hence, many students can demonstrate their creativity in class during discussions and examinations (Wu, et al., 2014). Thus, it can be said that present result indicates that Open Mindedness, Inquisitiveness, Analyticity and Truth-Seeking subscales reflect more rational aspect of critical thinking than, Self-Confidence and Sistematicity subscales. Accordingly, it can be said that adaptive aspect of creative thinking is related with critical thinking more than innovative aspect of creative thinking. The present result is very meaningful in terms of interacting of the creative thinking and critical thinking skills in the adaptive aspect. In other words, it can be said that critical thinking dispositions of Open Mindedness, Inquisitiveness, Truth-Seeking, and Analyticity are rather adaptive and rational than that of Self-Confidence and Sistematicity.

The relationship between *Elaboration* and *Truth-Seeking*:

Overall, this result can be said that is supported by Chang, et al. (2015), who found that critical thinking correlated with the creative thinking to the Elaboration scores of students in middle school. Truth-Seeking can be correlated with Elaboration for difficult problems because both subscales involve actively seeking alternatives and considering the details of problems. Based on this result, it can be said that the significant relationship between creative thinking and critical thinking is activated when using a non-routine problem-solving process. Creativity enables the discovery of new solutions for problems (Cropley, 2001; Guilford and Hoepfner, 1971; Plucker, Beghetto, and Dow, 2004). Likewise, Seferoğlu and Akbıyık (e.g. 2006) reported that open-ended questions are important for the acquisition of critical thinking skills. Siegler (1989) claimed that non-routine problems have the greatest impact on the development of cognitive skills, as this type of problem expands the formation of new mechanisms in the cognitive process. In this way, non-routine problems solving can be used to improve cognitive activities including creative thinking and critical thinking. This indicates that creative thinking

and critical thinking skill are activated when solving this type of problem because both benefit from similar traits including sensitivity toward problem solving, problem identification. Thus, it can be expected that non-routine problem solving is a common trait of creative thinking and critical thinking can play important role in significant relationship.

Baker, Rudd, and Pomeroy (2001) found that the critical thinking disposition (CCTDI) and creative thinking (TTCT) abilities of college students are not closely connected. In contrast to that, Kao (2014) found positive correlation between analytical and creative thinking subscales positively among elementary school students. Although students in different level of education have different correlation strengths on creative and critical thinking, present result indicated that students in the Department of Visual Arts Education and Religion & Ethics Education had more correlation strength between two thinking skills than students in Mathematics Education and Preschool Education. The relationship between creative thinking and critical thinking of students in The Department of Visual Arts Education and Religion & Ethics Education was found to be medium and significant, whereas it was not found to be significant for students in the departments of Mathematics Education and Preschool Education.

There can be various reasons of the present result, but the most important reason among possible reasons can be related to education departments. The participants of present study were in their fifth semester in middle of of their schooling for an undergraduate degree. Considering they have to pursue their education departments for eight semester, the Visual Arts Education and Religion & Ethics Education may not enough acquire education outcomes related with their education departments. Therefore, medium level correlation can be provided substitute of strong correlations might be provided. This situation indicates that students in higher education cannot acquire education outcomes completely unless they graduate academic education years as eight semester.

The potential for creative thinking exists in all humans, and this potential can be improved through education (Aslan, 2002; Gartenhaus, 2000; Taylor and Sacks, 1981; Torrance, 1988; Yontar, 1992). It can be said that critical thinking as a potential thinking is not separate from creative thinking in terms of thinking skills. As Schafersman (1991) stated, as an individual thinks critically, that individual can transform the information creatively. Also Paul (1992) added creativity to the list of critical thinking traits. He stated that creativity presupposes critically, and critically presupposes creativity. Thus, the significant relationship between creative thinking and critical thinking of students in the Departments of Visual Arts Education and Religion & Ethics Education indicates that present potential can be improved through education.

Visual Arts Education and Religion & Ethics Education are based on art and religion, respectively in terms of training program. The terms art and religion have the potential for generating comments on issues or problems that have no previous comments or known solutions. It can be said that this situation can be caused by an individual's different assessment or solutions for issues or problems rather than regular, formal assessments or solutions. Thus, it can be said that students in the departments of Visual Arts Education and Religion & Ethics Education have a tendency to solve more non routine problems due to the nature of their educational outcomes and/or learning climate, whereas students in Mathematics Education and Preschool Education encounter more lectures and are more accustomed to the routine problem-solving processes. This is a possible explanation for the significant correlation between creative thinking and critical thinking of students in the departments of Visual Arts Education and Religion& Ethics Education because these students have opportunity to encounter more non routine problems than ones in Mathematics Education and Preschool Education departments. Therefore, Miller and Lambert (2012) stated that the first experiences with arts education can be the gaining critical skills. Considering that creative thinking and critical thinking are activated during non-routine problem-

solving processes, the frequency of encountering non-routine problems can be a significant factor linking creative thinking and critical thinking skills of students.

Accordingly, critical Thinking is closely related to problem-solving and creative thinking (Facione, 1990), because there is interesting interaction between critical and creative thinking when individuals need to solve difficult problems the processes of problem solving (Glassner and Schwarz, 2007). Hence, Critical thinking ability is the most appropriate activity for problems we encounter (Renaud and Murray, 2008) and productive thought also incorporates both creative thinking and critical thinking (Newton and Beverton, 2012). That is, the critical skill is an expression of creativity so, it is impossible to gap between critical and creative thinking (Glassner and Schwarz, 2007). Although creative thinking and critical thinking include many common traits, there is very little research to determine the relationship between both thinking skills and little is known about this relationship. In terms of learning, these thinking skills remain important for students. Also, as Chang, et al. (2015) stated, the teaching effect of creative thinking and critical thinking has been still investigated, but what would happen if critical thinking meets creative thinking remains unknown. Under the light of present result, it can be put forward that non routine problem solving process, indicates both this meeting point and the most common trait of creative thinking and critical thinking.

For the results of this present study, it can be concluded that the solving process of non-routine problems hold a special role in the significant relationship between creative thinking and critical thinking, as it is a component of both thinking skills. The result of this study is also meaningful because it shows that non-routine problem solving process can play important role in the development of creative thinking and critical thinking skills of students in education using actively methods and techniques in terms of training. That is, the teachers must be consider the various types of problems as non-routine ones originating from the real life through connecting with education curriculum during the lecture in the classroom. Based on the present study result, it can be suggested that curriculums prepared in the future should include different type of problems apart from routine problems for students to possess more outcomes upon the relationship between creative thinking and critical thinking disposition. Hence, it is suggested that non routine problem solving process should be more place in education activities due to similar inputs produce similar outputs in education.

5. REFERENCES

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Uzun Özet

Hızlı teknolojik gelişmelerin de katkısıyla günlük yaşamımızda geçmiş yıllara göre daha sık olarak hazır, bilinen bir çözümü olmayan rutin dışı problemlerle karşılaşmaktayız. Birey, bu tür problemleri çözebilmek için yaratıcı düşünme ve eleştirel düşünme gibi üst düzey düşünme becerilerine gereksinim duymaktadır. Eleştirel düşünme, mantıklı karar vermeye odaklı, eldeki bilgiyi değerlendirerek mevcut problemi çözme becerisini de içeren bir düşünme biçimidir. Yaratıcı düşünme ise, yeni fikirler bulup, alışılmadık ilişkiler kurabilen, bu yönüyle problem çözmeye oldukça etkili olan bir düşünme sürecidir. Hiç şüphesiz, yaratıcı düşünme ve eleştirel düşünme birçok özelliği barındırmaktadır ancak, her iki düşünme biçiminin ilgili alan yazında ağırlıklı olarak kabul edildiği gibi kurallara sıkı sıkıya bağlı kalmak yerine araştırmacı, yenilikçi ve özellikle rutin dışı problem çözmeye karşı duyarlılık açısından ortak özelliklere sahiptir.

Bu çalışmanın amacı, yaratıcı düşünme ve eleştirel düşünme arasındaki ilişkiyi belirlemektir. Bu amaçla, 2012-2013 öğretim yılının güz döneminde Resim İş Eğitimi, Okul Öncesi Eğitimi, Din Kültürü ve Ahlak Bilgisi Eğitimi ve Matematik Eğitimi bölümüne devam eden 174 üniversite öğrencisine Torrance Yaratıcı Düşünme Testi ve California Eleştirel Düşünme Eğilimi Ölçeği uygulanmıştır. Araştırmadan elde edilen verilerin istatistik sonucuna göre, öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasında olumlu yönde düşük düzeyde anlamlı ilişki bulunmuştur. Bu sonuç ilgili alan yazında raporlanan çalışma bulgularıyla tutarlıdır. Ayrıca, bu araştırmada elde edilen veriler ışığında her iki ölçeğin alt boyutları açısından da istatistik analizi yapılmıştır. Buna göre;

- Eleştirel düşünme alt boyutu *Analitiklik* ile yaratıcı düşünme alt boyutları *Yaratıcı Kuvvetler*, *Zenginleştirme* ve *Erken Kapamaya Direnç* arasında,

- Yaratıcı düşünme alt boyutu *Yaratıcı Kuvvetler* ile eleştirel düşünme alt boyutlarından *Açık Fikirlilik*, *Meraklılık* ve *Doğruyu Arama* arasında,

- Yaratıcı düşünme alt boyutundan *Zenginleştirme* ile eleştirel düşünme alt boyutu *Doğruyu Arama* arasında olumlu yönde anlamlı ilişki bulunmuştur.

Eleştirel düşünme alt boyutlarından *Analitiklik* problemleri anlamaya yönelik bir eğilim olarak tanımlanmaktadır. *Açık Fikirlilik* ise farklı düşüncelere ve yapılan hatalara hoş görüyü ifade etmektedir. *Meraklılık*, farklı sorunları anlamaya yönelik bir eğilimdir. Eleştirel düşünme alt boyutu *Doğruyu Arama* da farklı yorum ve düşüncelerin nesnel değerlendirmesini içermektedir. Yaratıcı düşünme alt boyutlarından *Yaratıcı Kuvvetler*, Torrance'ın yaratıcılıkla ilgili tanımına uygun olarak problemlere karşı duyarlı olma, problemi tanımlama ve çözüm yolları önermedir. *Zenginleştirme* ise bir fikri, düşünceyi çeşitlendirme bağlamında işlev görür. *Erken Kapamaya Direnç* de açık fikirliliği koruyarak, problemleri sorgulamayla ilişkilendirilmektedir. Buna göre, yukarıda sözü edilen alt boyutların ortak özelliğinin yeni bir durum, sorun ya da problem karşısında bu durum, sorun ya da problemi anlamaya ve çözmeye yönelik bir eğilimi, yaratıcı düşünme eleştirel düşünmenin ilgili alan yazındaki tanımlarına paralel olarak görmenin mümkün olduğu söylenebilir.

Bu araştırmada ayrıca, öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasındaki ilişkinin öğrenim gördükleri bölümlere göre analizi de yapılmıştır. Buna göre, Resim İş Eğitimi ve Din Kültürü ve Ahlak Bilgisi Eğitimi gören öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasında orta düzeyde anlamlı ilişki bulunurken, Okul Öncesi Eğitimi ve Matematik Eğitimi bölümüne devam eden öğrencilerde düşük düzeyde anlamlı olmayan ilişki bulunmuştur.

İlgili alan yazında yaratıcı düşünme problemlere yeni çözümler bulmayla ilişkili görülürken, eleştirel düşünme becerisinin kazanılmasında açık uçlu sorulara yanıt aranmasının önemi vurgulanmaktadır. Problemlere yeni çözümler bulunması ve açık uçlu soruların içerik bakımından rutin dışı problem çözme bağlamında benzeştiği göz önünde bulundurulursa, her iki düşünme biçiminin rutin dışı problem çözme sürecinde olumlu yönde etkileşmelerinin mümkün olduğu söylenebilir. Rutin dışı problemleri çözme süreci, düşünme becerilerinin geliştirilmesi açısından olumlu yönde önemli etkileri olduğu bilinmektedir. Bu durum özellikle araştırmanın diğer bulgusu olan öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasındaki ilişkinin öğrenim gördükleri bölümlere göre ayrışmasının da nedenini açıkladığı ileri sürülebilir. Bu araştırmada, Resim İş Eğitimi ve Din Kültürü ve Ahlak Bilgisi Eğitimi gören öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasındaki ilişkinin, Okul Öncesi eğitimi ve Matematik Eğitimi'ne devam eden öğrencilere göre yüksek düzeyde ve anlamlı

bulunmuştur. Resim İş Eğitimi ve Din Kültürü ve Ahlak Bilgisi Eğitimi, Okul Öncesi eğitimi ve Matematik Eğitimi'ne göre öğrenim açısından hazır çözümleri bulunmayan ve belli bir formüle dayanmayan problemlerle karşılaşma olasılığı daha fazla olan eğitim alanlarıdır. Bu tür problemlerin rutin dışı problem bağlamında ele alındıkları göz önünde bulundurulursa, bu eğitim bölümlerine devam eden öğrencilerin yaratıcı düşünme ve eleştirel düşünme becerileri arasında kurdukları anlamlı bağın nedeni olarak rutin dışı problem çözme süreci gösterilebilir.

Yaratıcı düşünme ve eleştirel düşünme potansiyeli her bireyde mevcut olan düşünme becerilerindedir ve eğitimle geliştirilebilir. Her iki düşünme biçiminin birçok ortak özelliğe ve belli duyarlılıklara sahip olduğu da bilinmektedir. Bu durumun sonucu olarak, araştırmacıların da belirttiği gibi eleştirel düşünen birey aynı zamanda yaratıcı düşünebilmektedir. Bu araştırmanın sonucunun da ortaya koyduğu gibi yaratıcı düşünme ve eleştirel düşünme becerileri arasındaki anlamlı ilişkide belirleyici gücün rutin dışı problemleri çözme süreci olduğu söylenebilir. Bu nedenle, eğitim alanında bu tür düşünme becerilerinin geliştirilebilmesi için rutin dışı problemlere öğretim programlarında daha sık yer verilmesi önerilebilir.