

Çocuklarda Alana Özgü Yaratıcılığın Araştırılması: Sözel Olmayan Bir Yaratıcı Üretkenlik Testi ile Yaratıcı Problem Çözme Etkinlikleri Arasındaki İlişki

Exploring the Domain Specificity of Creativity in Children: The Relationship between a Non-Verbal Creative Production Test and Creative Problem-Solving Activities

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Öz

Bu çalışmada yaratıcılığın alana özgü ya da genel olup olmadığını araştırdık. Öğrencilerin DISCOVER (Discovering Intellectual Strengths and Capabilities While Observing Varied Ethnic Responses)' da yer alan üç problem çözme etkinliğinden (matematik, uzamsal artistik ve dilsel) aldıkları puanlar ile bir alana özgü yaratıcılık ölçme aracı ve TCT-DP (Test of Creative Thinking-Drawing Production)' den aldıkları puanlar arası ilişkiler incelenmiştir. Amerika Birleşik Devletleri'nin güneybatısı bölgesinde yer alan ve dilsel ve kültürel olarak çeşitlilik oluşturan iki okuldan 135 birinci ve ikinci sınıf öğrencisi araştırmanın katılımcıdır. TCT-DP ve üç DISCOVER yaratıcı problem çözme etkinlikleri arasındaki ilişkiyi açıklayabilmek amacıyla Pearson korelasyonları, kanonik korelasyonlar ve regresyon katsayıları hesaplanmıştır. Analizler sonucunda yaratıcılığın genel ve alana özgü boyutları olduğu bulunmuş, fakat alana özgü boyutunun daha belirgin olduğu görülmüştür. Bu bulgulara göre eğitimcilerin, üstün yetenekli öğrencilere yönelik özel programlara öğrenci seçiminde, yalnızca genel çoğul düşünme veya genel yaratıcılık testlerine güvenmek yerine alana özgü yaratıcılık ölçümlerine de dikkat etmeleri gerekmektedir.

Anahtar Sözcükler: Alana özgü yaratıcılık, yaratıcı problem çözme, DISCOVER, TCP-DP

Abstract

In this study, we explored whether creativity was domain specific or domain general. The relationships between students' scores on three creative problem-solving activities (math, spatial artistic, and oral linguistic) in the DISCOVER assessment (Discovering Intellectual Strengths and Capabilities While Observing Varied Ethnic Responses) and the TCT-DP (Test of Creative Thinking-Drawing Production), a non-verbal general measure of creativity, were examined. The participants were 135 first and second graders from two schools in the Southwestern United States from linguistically and culturally diverse backgrounds. Pearson correlations, canonical correlations, and multiple regression analyses were calculated to describe the relationship between the TCT-DP and the three DISCOVER creative problem-solving activities. We found that creativity has both domain-specific and domain-general aspects, but that the domain-specific component seemed more prominent. One implication of these results is that educators should consider assessing creativity in specific domains to place students in special programs for gifted students rather than relying only on domain-general measures of divergent thinking or creativity.

Keywords: Domain-specific creativity, creative problem-solving, DISCOVER, TCT-DP

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Are creative people creative in everything they do, or are they creative in certain areas and not in others? In other words, is creativity the same across all the domains of human ability and fields of human activity (domain general) or is creativity in one domain or field different from creativity in other domains or fields (domain specific)? Researchers have raised these questions extensively during the last five decades. Creativity researchers and those who developed creativity assessments have started to shift from the traditional view of creativity as general toward the domain specific view of this cognitive ability.

Domain Generality of Creativity

Some authors have believed that creativity was identical across all domains of human ability (Simon, 1976). Creative individuals in one domain should exhibit their creativity across other domains. Those who believed that creativity was domain general (Hocevar, 1980; Runco, 1986; Torrance, 1988; Crammond, 1994; Plucker, 1998) believe that creativity, as a general intellectual ability, affected the performance of the individual regardless of the specific or particular activity in which he or she is involved (Tardif & Sternberg, 1988; Treffinger, 1986) and that domain relevant skills contributed to creative performance (Weisberg, 1988). The belief in the domain generality of creativity have dated back to Guilford's theory of divergent production and his famous structure-of-the-intellect (SOI) model. Guilford advanced the idea that divergent production is the main cognitive process involved in creative performance in various domains (Kogan, 1994). In Guilford's SOI model, several kinds of divergent thinking existed: verbal, visual, and auditory. Guilford asserted that divergent thinking was different from creativity. He stated that divergent thinking was an important aspect of creativity and a skill that encompassed all performance in any domain (Guilford, 1987).

Guilford's theory was criticized because of inadequate empirical support and lack of relatedness to real-life creativity (Brown, 1989). The domain-generality view of creativity could be unsupported because of the lack of multiple-item tests (Chen, Kasof, Himsel, Dmitreiva, Dong & Xue, 2005). Several researchers reported evidence of domain generality of creativity using self-report measures of creative performance or measures of creative personality (Hocevar, 1981; Okuda, Runco & Milgram, 1991; Hong, Milgram & Gorsky, 1995).

Domain Specificity of Creativity

Researchers have posited that creativity might be a more specific trait than what was believed in the past (Csikszentmihalyi, 1988; Baer, 1993, Wallach, 1985; Gardner, 1983; Baer, 1991; Han & Marvin, 2002; Han, 2003; Kaufman & Baer, 2002) especially in the study of the relationship between creativity and giftedness (Runco, 1993; Runco & Nermiro, 1994) and the support of the role of the divergent thinking concept in domain-general creativity (Brown,

1989; Amabile, 1996a; Milgram, 1990; Hong, Milgram & Gorsky, 1995; Plucker, 1998; Treffinger, 1995). According to Li and Gardner (1993), “Domain is the bodies of disciplined knowledge, which have been structured culturally, and which can be acquired, practiced, and advanced through the act of learning” (p. 4).

According to Baer (1993), evidence for the domain specificity of creativity involved both specificity in the broad cognitive domains such as linguistic, logical-mathematical, and musical, and the narrower task or content domains such as storytelling and collage making. Some people preferred to call task or content domains *microdomains* (Karmiloff-Smith, 1992) and this kind of specificity sometimes has been referred to as *task specificity* rather than *domain specificity*. Baer (1998) concluded that if the domain-specificity hypothesis were correct and some exercises were selected from the same domain, an idea consistent with the domain-general hypothesis, then the loss would be obvious because any enhancement or training of creative thinking would be restricted to the single content domain from which the exercises are selected.

The idea of domain specificity of creativity has been around for a considerable time as evident in the work of Patrick (1937; 1938) and in the seminal research at Institute for Personality Assessment and Research (IPAR) with writers, architects, and other domains (Barron, 1969; Hall & MacKinnon, 1969). Gardner (1983), in his theory of multiple intelligences, challenged the proponents of the general creativity perspective. Gardner (1988) argued that human cognition should be considered as composed of a number of factors, with each factor functioning with regard to its own set of rules, and asserted that outstanding creative responses were linked to specific domains that involved different kinds of skills, distinct types of knowledge, and a significant period of specialized training (Gardner, 1993).

In learned variability theory, divergent thinking abilities have been considered domain specific (Stokes, 1995, 1999). Stokes (2001) asserted that in addition to the variability between participants on the same task or activity, differences existed across tasks for the same subject. This difference was consistent with Stokes’ idea (1995, 1999) that “variability levels, like skills, are domain specific and learned” (2001, p. 279). Several researchers reported evidence for the domain specificity of creativity (Baer, 1991; Runco, 1987; Weisberg, 1988; Han, 2002, 2003).

Domain Generality and Domain Specificity of Creativity

Amabile (1996), in her componential model of creativity, presented a third perspective that combined domain specific and domain general skills. The model consisted of three essential components. Domain-relevant skills were those basic skills that led to skillful performance in a specific domain (math or oral linguistic). Creativity-relevant skills were those skills that cut across domains of creative performance. Task motivation entailed motivations or attitudes toward the task. Amabile (1996) found evidence for general creativity skills across different tasks within a domain and general creativity skills across quite different domains.

Researchers, in studies using a correlation between a general measure of creativity and a domain specific measure, found significant positive correlations between the two kinds of measures (Diakidoy & Spanoudis, 2002). This finding was consistent with Sternberg's (1989) view that domain specificity and domain generality were complementary, both working in an interactive way to produce performance differences. The variation in the correlations among activities has provided the support what Lubart (1994) suggested: the domain specificity of creativity could be explained through the cognitive, personality-motivational, and environmental components of creative performance. He posited that such components such as knowledge and risk taking were considered specific, while others such as cognitive abilities might be general. He asserted that this combination of several components within the same individual would explain the weak inter-domain or inter-task correlations.

Whether creativity is domain specific or domain general has been a subject of debate that entails some conceptual and methodological concerns (Plucker, 1998). A limitation of the methods used by the proponents of the domain specificity view of creativity has been that many of the researchers did not use a battery of divergent thinking tests. Using more than one divergent thinking test would help in delineating the differences among high divergent thinkers and low divergent thinkers, simply because each test would be characterized by its own aspects of divergent thinking (Kogan, 1994; Han, 2003).

Performance-based Assessments

One of the areas that researchers did not study was the use of real-world creative performance or problem-based-learning situations. Authors have agreed that divergent thinking tests were good indicators of the potential for solving real life problems provided that they contained the kinds of problems or situations that children might encounter in their daily-life interactions (Runco, 1993; Hong & Milgram, 1991; Han, 2003). Denying the view that creativity might be domain general has meant denying the significance and importance of divergent thinking in creativity assessment. This view has represented a critical threat to the most currently and widely used criteria for identifying and serving creative and gifted children (Baer, 1993). If researchers assumed that the domain-general view of creativity (supported by the use of divergent-thinking tests) were not accurate, the current criteria for identifying both creative and gifted children would represent a very fragile basis for making placement decisions (Baer, 1993; Han & Marvin, 2002).

One possible solution for resolving the conflict about the domain specificity/generality of creativity would be to use performance-based assessments of children's creative problem-solving abilities. The advantages of this approach have included testing students in real-life situations, including both the process and product in assessment, using testing materials that attract the students, and assessing higher-order skills (Fletching, 1991). Other advantages of using performance-based assessments have included (a) involving a broad spectrum of domains of cognitive functioning such as those in Gardner's theory of multiple intelligences, (b)

using the participants' first language for the assessment to overcome expressive difficulties, (c) reaching the rating or the final evaluation via consensus of several observers or raters who agree about the performance of the participant (inter-rater reliability), (d) overcoming the problems that result when IQ scores are added across several domains (yielding a score representing general intellectual ability). In widely used divergent thinking tests, creativity scores also have been summed across domains. Finding domain-specific abilities has been difficult because the domains were not separated, and (e) providing an intelligence-fair method for assessing human abilities. This last idea came from Gardner (1992), who believed that "the solution, easier to describe than to realize, is to devise instruments that are 'intelligence-fair', which look directly at intelligence-in-operation rather than proceed via the detour of language and logical faculties" (p. 91).

Researchers who have studied performance-based assessments of creative problem-solving have examined creative production in different domains such as story-telling, writing, mathematics, and arts (Baer, 1991; Baer, 1993; 1996; 1998; Han, 2000). Plucker (1998) asserted that performance-based assessments offered the evidence for the domain specificity of creativity whereas traditional assessments provided the evidence for the domain generality of creativity. One concern has been that the researchers who used divergent thinking tests relied on the total scores across domains. Therefore, the score in divergent thinking tests is a composite. On the other hand, authors who used performance-based assessments showed evidence of domain specificity because performance assessments were focused on the quality of creative performance and have studied the creative products in different domains such as math, art, collage, and writing (Baer, 1991; 1993; 1994; 1998; Conti, Coon & Amabile, 1996).

In the Discovering Intellectual Strengths and Capabilities while Observing Varied Ethnic Responses (DISCOVER) performance-based assessment (Maker, 2001), trained observers have examined students' creative processes and products in domains such as logical-mathematical, oral linguistic, spatial artistic, writing, and spatial analytical. Observers used a method similar to Amabile's (1982, 1996b) consensual assessment technique in which raters judged the participants' creative products by comparing them to each other, rather than against an absolute criterion. Researchers who have studied performance-based assessments, in which participants were asked to create various products in different domains, have found either weak or negative correlations among the creativity ratings for the products created in different domains (Kaufman & Baer, 2002; Baer, 1991).

Sarouphim (2000, 2002, 2004) conducted a series of studies using the DISCOVER assessment activities (spatial artistic, spatial analytical, logical mathematical, and written linguistic) and found evidence for the domain specificity of creativity. The participants in these studies were in grades K, 2, 4, 5, 6-8, and 9-12. Low correlations were found among observer ratings on the assessment activities. For example, the correlations between spatial artistic and spatial analytical ranged from .02 to .23; between spatial artistic and math, from .09 to .26; between spatial artistic and oral linguistic, from .07 to .14; between spatial artistic and written linguis-

tic, from .01 to .28; between spatial analytical and math, from .00 to .52; between spatial analytical and written linguistic, from .08 to .29; and between math and oral linguistic, from .01 to .39. At the high school level, low correlations were found between observer ratings. For example, the correlation between spatial artistic and interpersonal was .23; between written linguistic and interpersonal .23; and between oral linguistic and interpersonal .29.

Purpose Statement and Research Questions

The current study was different from Sarouphim's (2000, 2002, 2004) studies in that we also studied the correlation between the DISCOVER results and the Test of Creative Thinking-Drawing Production (TCT-DP) as a measure of domain general creativity. The purpose of this study was to examine the domain-specificity/generalizability of creativity through the comparison of students' performance on the TCT-DP, developed as a general measure of creative potential, and three of the DISCOVER problem-solving tasks developed as a measure of creative problem-solving in a variety of domains. The researchers answered the following questions:

1. What was the relationship between students' performance on the TCT-DP total score (a general measure of creativity involving a spatial-artistic task) and the three DISCOVER assessment activities; spatial artistic, oral linguistic, and math (a domain-specific measure of creative problem-solving)?
2. Was students' creative performance in one domain (math, oral-linguistic, and spatial artistic) related to their creative performance in other domains (math, oral linguistic, and spatial artistic)?
3. To what extent was creativity domain specific or domain general?

Method

Participants

Data for this study were collected as part of a larger study of the DISCOVER assessment and curriculum models. Participants were first and second grade students from two schools located in the Southwest region of the US. The total number of students participating in both the DISCOVER assessment and the TCT-DP was 135. The majority of the students came from culturally, ethnically, and linguistically diverse backgrounds: African American, Mexican American, Navajo, and Caucasian. The students' gender and grade have been presented in Table 1.

Materials

DISCOVER. The DISCOVER assessment theoretical framework was based on Sternberg's theory of the Triarchic Mind (Sternberg, 1991), Gardner's theory of multiple intelligences

(1983), and Maker's (1993) definition of giftedness. This assessment was developed by Maker and her colleagues (Maker, 1996; 2001) to identify gifted students from culturally and linguistically diverse backgrounds. The main purpose of this tool was to assess and nurture the creative problem solving abilities of children and youth. One important element that distinguishes DISCOVER from other assessment tools was the problem continuum adapted from the research of Getzels and Csikszentmihayli (1967). In this model, problem-solving situations were classified according to the extent to which the presenter or the solver knew the problem, method or solution. Type I and II in the continuum were well-structured requiring mainly convergent thinking. Students had to reach the correct solution that was already determined by the presenter. On the other end of the continuum, problem types were open-ended requiring mostly divergent thinking. Students had to decide what was correct from their own problem solving perspective. Table 2 shows the problem types. Types I, II, and VI were in the original system developed by Getzels and Csikszentmihayli (1976). Problem Types III, IV, V, and VI were added by Maker and Schiever (1991, 2005). A careful analysis of the problem-solving continuum, especially problem Types IV, V, and VI, would support the view that the DISCOVER assessment was a measure of creativity. The open-ended, divergent, and productive nature of the perspectives and ideas that students created during the assessment was closely related to the measurement of creativity.

The DISCOVER assessment consisted of activities designed for four different grade levels: K-2, 3-5, 6-8, and 9-12. The DISCOVER assessment provided students with an opportunity to demonstrate their creative problem-solving abilities in activities in five domains: spatial artistic, spatial analytical, logical-mathematical, oral linguistic, and written linguistic. In the current study, students participated in the K-2 version. The process of assessment consisted of having one observer sitting with a group of 4 or 5 students at a table. The observer watched the problem-solving behaviors exhibited by the students while they participated in the different activities of the assessment. To overcome any bias on the part of the observer, observers rotated when they were finished with each activity so that the student was assessed only once by each observer.

The psychometric properties of the DISCOVER assessment tool have been investigated in a variety of studies. Griffiths (1996) examined the inter-observer reliability of DISCOVER in two studies. In the first study, positive and significant correlations were found between the ratings of the observers who watched videotapes of children's performance on the DISCOVER activities and the ratings of original observers in classrooms. The highest correlation was 0.81, showing a high agreement among the three observers. In the second study, the agreement between the researcher (experienced) and six observers with various levels of experience in the observation process ranged from 80 to 100 %.

To assess the validity of DISCOVER, Griffiths (1997) examined the relationship between students' ratings on each of the DISCOVER activities (spatial artistic, spatial analytical, logical-mathematical, oral linguistic, and written linguistic) and their scores on various subtests

of the WISC-III. She found evidence for comparative and concurrent validity of the DISCOVER assessment. Sarouphim (2001) reported low but significant correlations between students' scores on the Raven Progressive Matrices and their ratings in spatial artistic ($r = .58$, $p < .01$), spatial analytical, ($r = .39$, $p < .01$), and math ($r = .35$, $p < .01$). The study provided evidence for the concurrent validity of DISCOVER.

Sak and Maker (2003) provided evidence for the predictive validity of the DISCOVER assessment. Comparisons of gifted and non-gifted kindergarten students' performance on DISCOVER activities and their academic achievement in the 3rd and 6th grades on Stanford 9 and Arizona's Instrument to Measure Standards (AIMS) were made. For example, linguistically gifted students had significantly higher scores than those not identified as linguistically gifted in Stanford Reading, and students gifted in logical mathematical and spatial analytical activities had higher scores in Stanford 9 Math and AIMS Math than students not identified as gifted in either logical-mathematical or spatial-analytical activities.

The Test for Creative Thinking-Drawing Production (TCT-DP). The TCT-DP is a screening instrument that allows for a first rough, simple, and economic assessment of a person's creative potential (Urban & Jellen, 1996). The intent is to identify high creative potential as well as to recognize individuals with underdeveloped creative abilities who are in need of promotion, challenge, and support. The authors believe that using the modality of drawing has guaranteed the highest degree of culture fairness, overcoming the problems of using traditional intelligence testing in the assessment of creative potential in children, in addition to the use of the instrument in most age and ability groups from various educational, socioeconomic, and cultural backgrounds (Urban & Jellen, 1996).

Several studies have been conducted to assess the reliability of the TCT-DP in different cultural contexts. After several pilot studies, the first investigation (Urban & Jellen, 1986) with the TCT-DP was conducted on four groups of seventh graders from different academic achievement levels. High correlations ranging from .89 to .97 were found between 6 different trained scorers. Gyebnar & Karpati (1994, cited in Urban & Jellen, 1996) found, when using the test with a Hungarian sample, that the parallel test reliability was high ($r = 0.70$). Brocher (1989, cited in Urban & Jellen, 1986) used the TCT-DP as a pre- and post-test in creativity training with gifted students. He found that both the control and training groups showed high re-test reliability ($r = 0.81$ and $r = 0.71$ respectively). Herrmann (1987, cited in Urban & Jellen, 1996) rated the scoring reliability as very high; his findings showed a correlation between two independent scorers of .92 and .91.

Rudowics (2004) found good evidence of internal consistency, test-Retest and inter-rater reliability for the TCT-DP. For inter-rater reliability, the correlations ranged from .99 for Completion (Cm) to .62 for Humor (Hu). Most of the 14 criteria had an inter-rater reliability of .85 or greater. Internal consistency for the 13 assessment criteria, not including speed, had a Cronbach alpha coefficient of .73. For the test-Retest reliability, the correlations for the 12

criteria were low, ranging from .22 to .38. Wolanska and Necka (1990; cited in Urban & Jellen, 1996) reported a moderate significant correlation for the retest reliability ($r = .46$).

Answering the question of validity of the instrument in a cohesive way has been difficult because they believe that no comparable instruments have been available (Urban & Jellen, 1996). Correlations between the TCT-DP and intelligence test scores were near zero. The authors of the test believed that this result added to the evidence of the validity of the test because it showed that the test measured something different from convergent thinking represented in academic achievement (Urban & Jellen, 1996). However, Wolanska and Necka (1990; cited in Urban & Jellen, 1996) reported significant correlations between the TCT-DP and the Raven Progressive Matrices ($r = .21$ to $.41$) for various age levels.

Although the test manual included only the evidence cited above, some researchers in other cultures provided such evidence. For example, Rudowicz (2004) found evidence of concurrent and discriminant validity of the TCT-DP. The correlation coefficients between the TCT-DP scores and self-rated creativity ranged from $r = .22$ for the entire sample to $r = .31$ in the top intelligence group ($p = .01$). For discriminant validity, the correlation between the total TCT-DP scores and the scores on the Raven's Progressive Matrices was low, but statistically significant ($r = .28$, $p = .01$). Also, Dollinger, Urban, and James (2004) found evidence of convergent and discriminant validity of the TCT-DP. The TCT-DP was significantly correlated to creative products (oral linguistic, autobiographical photo-essay and personality traits assessments) and the Thematic Apperception Test (TAT). Chae (2003) adapted the TCT-DP in South Korea and found results similar to the original results stated by Urban and Jellen in the German samples. The author found empirical evidence that the TCT-DP was a culture-fair instrument and that it could be adapted to Korean preschoolers without additional standardization.

On the test sheet, six figural fragments were presented, stimulating further drawing in a free and open way: a semi-circle, a point, a large right angle, a curved line, a broken line, and a small open square outside the large square frame. The drawing product was evaluated and scored by means of 14 evaluation criteria: continuations, completion, new elements, connections made with a line, connections made to produce a theme, boundary breaking that was fragment dependent, boundary breaking that was fragment independent, perspective, humor, and affectivity, unconventionality A, unconventionality B, unconventionality (sub scores A, B, C, D) and speed (Urban & Jellen, 1996). These fourteen scores were then combined into a total score.

Procedure

The first phase of the assessment consisted of observers administering the first three activities (spatial artistic, spatial analytical, and oral linguistic) with the two remaining (written linguistic and math) administered by the classroom teacher using worksheets. The observers, while watching the students' performance on the first three activities, used an observer notes

sheet in which he or she recorded his or her observations about the products and problem solving behaviors of the students during their work on the activities. Observers did not interpret what they observed, but wrote what they saw or heard exactly. They recorded students' problem-solving behaviors through taking pictures, audio taping, and videotaping. The following is a brief description of the three activities used in this study.

Spatial Artistic. This activity included colored cardboard pieces of different shapes and sizes. The observer showed the students a design and asked them to make it with the construction pieces (different constructions such as animals and flowers). The observer took notes about the complexity of the constructions, the number of pieces involved, and the unique elements in the product. The observer or an assistant took several pictures of the students' products to help in the process of assigning the ratings according to the consensus among the raters or the observers.

Spatial Analytical. Students were given a set of Tangrams (21 pieces of different shapes such as squares, triangles, and parallelograms of different sizes). In the first phase, students were asked to make geometric shapes using as many Tangram pieces as possible. Then, they were asked to complete as many pages as they could in a booklet of six puzzle sheets varying in the level of difficulty, ending up with two challenge pages. If they completed the booklet until time remaining, they were asked if they wanted to work a "challenge" page.

Oral Linguistic. Students were given a bag of toys that contain two animals, two people, two things, and one wheeled toy. At the beginning of the activity, the observer asked questions about grouping or clustering these toys together according to the common characteristics. At the end of the task, students were asked to tell a story about any or all of the toys in their bags. The observer audio-taped students' stories.

Logical-Mathematical. In the first section of the activity (Problem Type I), students solved math problems that required clearly defined answers. Students knew what mathematical operations and methods they were to use. In Problem Type II, teachers presented a problem with correct solutions but for which the method was not described clearly. In Problem Type III, students made correct subtraction, addition, multiplication, and division problems using only the three numbers given in the problem. In the last section (Problem Type IV), students wrote as many equations as they could that had a certain number as the answer. The answer was given. Students were encouraged to make as many problems as they could that equaled the given number.

Scoring. To assign a rating, the observers were guided by a summary sheet exhibiting each student's problem solving behaviors on the five tasks of the assessment. For example, in the spatial analytical activity, the observer noted the number of puzzle sheets the student solved, the strategy he or she used, the time spent on solving the puzzle, and the number of pieces the student used in forming an initial shape such as a square. Observers met in a debriefing

session to discuss the problem-solving behaviors of students and to get to a consensus on a rating from 1 to 5 showing the level of problem-solving ability exhibited by each student in each activity.

For the purpose of the current study, the researchers chose three of the creative problem-solving activities (spatial artistic, spatial analytical, and oral linguistic) for the comparison with the TCT-DP total and sub-scores.

The TCT-DP was administered in all classrooms in the two schools. It was given using standard administration and evaluation procedures developed by Urban and Jellen except that only form A was given because of the numbers of students being assessed. The test sheet was evaluated using the 14 evaluation criteria: each had a score range with a different number of points. For example, some criteria have a range of 0 to 3; others have a range of 0 to 6 points. Each student's drawing was assessed on the 14 evaluation criteria and given a point by a trained judge. A total score for the TCT-DP was calculated with the maximum number of points equal to 72.

Using SAS, Pearson correlations, canonical correlations, and multiple regressions were calculated to determine the relationship between the TCT-DP total score and its sub-scores (14 criteria), and the three DISCOVER creative problem-solving activities (spatial artistic, spatial analytical, and oral linguistic).

Results

Descriptive data for the TCT-DP and the DISCOVER activities have been presented in Table 2. Pearson correlations showing the relationship between the TCT-DP total score and the three DISCOVER creative problem solving activities have been presented in Table 3. The oral linguistic activity was significantly correlated with the TCT-DP total score ($r = .18, p = .05$). No significant correlations were found between the other two activities, math and spatial artistic, and the TCT-DP total score.

As for the relationship among the three DISCOVER problem solving activities, only one significant correlation was found. The spatial artistic activity was correlated significantly with the oral linguistic activity ($.25, p = .01$). The canonical correlation between the 14 TCT-DP criteria and the three DISCOVER problem solving activities was $R_c = .41$, and R_c adjusted for the number of variables was $.30$ (n.s.). Multiple regressions, each time with one DISCOVER activity score, predicted by the 14 scores yielded no significant results. The R-squared for these regressions was notably low, $.11, .12$, and $.05$ for spatial artistic, math, and oral linguistic respectively. Finally, a multiple regression of the three DISCOVER activities (spatial artistic, math, and oral linguistic) on the total TCT-DP score showed 6 % shared variance ($R^2 = .06$; adjusted $R^2 = .04$) which was significantly different from no shared variance, given the sample size, but quite weak ($F [3, 131] = 2.80, Mse = 93.47, p = .05$).

Discussion

The purpose of this study was to investigate whether creativity is domain specific or domain general. We investigated the relationship between the TCT-DP total and sub-scores (a measure of domain general creativity) and three of the DISCOVER assessment creative problem solving activities in a sample of 109 elementary school students. We suggest, in the light of the results of the study, that strong support for the theory of domain specificity of creativity is found.

Most of the correlations either among the three DISCOVER activities or between the DISCOVER activities and the TCT-DP scores were low and non-significant. Only the oral linguistic activity was correlated significantly with the TCT-DP total score ($r = .18$, $p = .05$). As for the correlations among the three DISCOVER activities, only one significant correlation was found, between oral linguistic and spatial artistic ($r = .24$, $p = .01$). The canonical correlation between the DISCOVER assessment activities and the 14 TCT-DP criteria is $R_c = .4$; which indicates that a canonical correlation between the two sets of variables, as observed, can occur by chance. Multiple regressions, each time with one DISCOVER activity score, predicted by the 14 TCT-DP scores yielded no significant results. The R-squared for these regressions were notably low: R-squared for spatial artistic, math, and oral linguistic were .11, .12, and .05 respectively. Again, these results provide support for the domain specificity of creativity as only low correlations existed between a measure of domain-general creativity (TCT-DP) and a measure of domain-specific creativity (DISCOVER activities). The weak correlation between the TCT-DP and the spatial artistic activity argues in favor of task specificity, because both tasks involved visual-spatial expression.

The findings of this study are consistent with previous literature in that non-significant correlations have been found among scores on divergent thinking measures and scores on the measures in a variety of creative performance domains such as math and spatial artistic (Baer, 1991; Baer, 1993; Han & Marvin, 2002). Also, the results of the current study are consistent with those of researchers who found low correlations between creativity in specific domains (such as the domain specific measure used in this study; DISCOVER assessment activities) and creativity assessed with other general measures such as the TTCT (Diakidoy & Spanoudis, 2002) and the Wallach-Kogan Creative Thinking Test (Han, 2003; Han & Marvin, 2002) which are tools to measure domain general creativity.

The results are inconsistent with previous literature (Torrance, 1972; Wallach & Kogan, 1965; Bartlett & Davis, 1974; Hong, Milgram & Gorsky 1995) in which researchers found significant correlations between divergent thinking measures and different creativity assessments such as writing, math, science, and crafts. The results of these studies might be different from this research because of the difference in the assessment tools used to assess creativity.

The findings of this study also support the notion that performance-based assessments tend to show that creativity is domain specific. Han and Marvin (2002) concluded that few stud-

ies, to date, have included performance assessment and that very few studies have included expert consensus (the way in which the DISCOVER assessment activities are scored) in assessing children's products and problem solving processes during performance-based activities to investigate the question of domain specificity/generalizability of creativity. Researchers also proposed that using multiple assessments in diverse domains and assessments that are related to daily life performance are deemed vital to assess various kinds of creative abilities in children.

Plucker (1998) asserts that performance-based assessments show evidence for domain specificity of creativity whereas traditional divergent thinking assessments provide evidence for domain generalizability of creativity. One concern is that researchers who use divergent thinking tests calculate total scores across domains. Therefore, the scores on the divergent thinking tests are composites. On the other hand, authors who use performance-based assessments showed evidence of domain specificity because performance assessments are focused on the quality of creative performance on a particular task.

In addition, the determination of generalizability or specificity of creativity might not be the result of the use of a self-report or performance-based assessment, but the result of using certain divergent thinking measures used to assess domain general creativity. This finding poses an important question for future research on how to use divergent thinking measures effectively to determine the issue of domain specificity/generalizability of creativity.

Han (2003) believes that conclusions reached from many studies of creativity lack verified theoretical foundations. Moreover, some methodological questions have been raised concerning the most appropriate statistical procedures used in investigating the domain specificity/generalizability of creativity. Researchers who use bivariate analysis tend to have results showing domain specificity of creativity whereas researchers who use multivariate analyses tend to find support for the domain-generalizability perspective of creativity.

The results of this study provide support for Han and Marvin's (2002) assertion that some divergent thinking measures might not actually explain children's creative potential. When a child gets a high score on a general measure of creativity, this does not demonstrate his actual strength in a certain domain because the score is only a representation of his overall potential. This finding might be problematic in the sense that gifted children are screened and identified according to their overall scores on general measures of divergent thinking, but are placed in programs to develop academic creativity in specific domains.

The variation in the correlations among activities in this study provided support for what Lubart (1994) suggests: domain-specific creativity could be interpreted through the cognitive, personality-motivational, and environmental components of creative performance. He asserts that this combination of several components within the same individual could help to explain the low inter-domain or inter-task correlations. Lubart and Guignard (2004) contend that these three attributes are called multivariate, componential, or confluence approaches as

different attributes have to congregate to produce creative behavior. They assert, like Amabile (1996), that creativity is in part domain general and in part domain specific because creativity entails the use of some intellectual capacities that are somewhat general and some that are specific or capacities that are both general and specific.

Implications for Research and Practice

Baer (2012) concludes that if creativity were domain general, then developing creative skills through training should have a positive impact on creative performance in all domains. He posited that "If one were teaching or practicing a truly domain-general creative skill, then it would be not matter what content one used for such practice. So if a teacher asked students to do a number of divergent thinking exercises, it really wouldn't matter whether once practiced by brainstorming unusual uses for bricks, words that rhyme with love, or things that taste like chicken" (p. 21). On the other hand, creativity training should focus on the creative performance in specific domains. Most creativity training programs focus on domain-general creativity. We found in this study that creativity is partially domain specific. We believe that creativity training should be more specific rather than general. We agree that students should get training on domain-general skills in creative performance (e.g. math, language arts, etc.), but they also need to get extensive training on domain-specific skills to get to the mastery level.

Another issue is related to the assessment of creativity. Most of the creativity assessment tools in the field measure domain-general creativity. Baer also stated that "one could assess domain-specific skills that might contribute to creative performance in one (or some) domain(s), but any measure of creativity would need to state for what domains it claims to be a valid measure" (p. 22). We believe that performance-based assessment would truly assess children's creative potential. We recommend that researchers should conduct more research on investigating the domain-specificity or-generality issue of creativity using other domain-general measures of creativity.

Limitations of the Study

There are some limitations for the generalization of the results of this study. One limitation is that the study sample consists of a group of minority students in the Southwest of the US, therefore, the results cannot be generalized to other populations. Also, the structure and scoring of the TCT-DP did not enable the analysis of the usual elements of creativity (flexibility, fluency, and elaboration). These creativity elements were blended on almost all the 14 evaluation criteria for the drawing product. The use of only one general measure of divergent thinking might be another limitation since it might not represent the divergent thinking ability of these children. The mixed results of the current study provide support for Sternberg's (1989) view that domain generality and domain specificity are complementary; both work together in an interactive way to yield performance variations. Based on current results, planning for programs for gifted students should include emphasis on domain specific

skills and not only domain general skills. The current study also focuses an important issue, which is the emergence of the use of performance-based assessment in the identification of children's domain specific creativity. Treffinger & Feldhusen (1996) pointed out that the identification of a creative child according to his domain specific ability could help in designing educational programs to enhance and nurture these abilities. As a result of this view, educational material presented to the students in schools should be tailored according to their domain specific abilities.

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