EMPIRICAL STUDIES OF THE ARTS, Vol. 22(2) 143-155, 2004

SURE, I'M CREATIVE—BUT NOT IN MATHEMATICS!: SELF-REPORTED CREATIVITY IN DIVERSE DOMAINS

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ABSTRACT

The degree to which creativity is domain-specific or domain-general remains hotly contested, but there is at least one area of agreement: people have different creativity profiles. In this study, we asked 241 students to give self-ratings of their creativity in different domains. These ratings were then studied for inter-correlations. We also examined how such self-assessments in diverse domains relate to other measures of cognitive ability and to creativity as measured with a personality scale. In general, if students viewed themselves as generally creative, they also viewed themselves as creative in different areas. The only area that was not correlated with general creativity ratings was mathematics.

If Einstein had devoted himself to writing poetry rather than physics, would his sonnets be remembered today? Could Emily Dickinson's genius have led to brilliant scientific theories rather than brilliant poetry? Or, on the level of more everyday, garden-variety creativity, if a person is creative in the way she solves interpersonal problems, is she also more likely than chance to be creative as a cook, an artist, or an inventor? In what ways are the creative-thinking skills important in diverse domains related to one another?

Putting these questions in a more general form, one might ask if creativity is a single thing or if it is many things. Is there perhaps some measurable *c,* analogous to *g,* that transcends domains and contributes to creative performance in all fields

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of endeavor? Or is creativity—above and beyond whatever contributions *g* might make—domain-specific, with a different set of factors contributing to creativity in different domains?[1] Or perhaps the answer is not one or the other, but both, as suggested by Amabile's (1996) componential theory, in which she argues that there are both general all-purpose creativity thinking skills and traits and more limited, domain-specific skills and traits (which combine with her third component, task motivation, to determine the actual level of creative performance one demonstrates on a given task).

At least since Guilford's (1956, 1967) structure of the intellect model,[2] creativity theorists have tried to understand the nature of creative thinking, and a key question has been how general, or how domain specific, are the cognitive and affective underpinnings of creative performance across diverse domains (Baer, 1998; Plucker, 1998). Creativity testing has assumed generality,[3] but this assumption has come under attack in recent years (see Baer, 1994b, 1994c, and Crammond, 1994, for a point-counterpoint on this topic; or Plucker & Runco, 1998, for a more general review of the issues involved).

There is much evidence for both the domain specificity and generality arguments. It has been suggested that the differences between research supporting domain specificity and that which supports generality may be due to a method effect (Plucker, 1998). Performance assessment studies tend to find evidence of specificity (e.g., Baer, 1991, 1993, 1994a, 1996; Runco, 1989), while "creativity checklists and other traditional assessments" (Plucker, 1998, p. 180) tend to find evidence of generality (e.g., Hocevar, 1976, 1979; Plucker, 1999). A study by Runco (1987) exemplified this effect by using both self-report and performance-based assessments of creativity. The self-report scales, which focused on the quantity of creative activities in which subjects engaged in various domains, evidenced generality of creativity across domains, but the performance assessments, which focused on the quality of creative performances in different domains, pointed to domain specificity of creativity.

[1] The term "domain" has notoriously fuzzy boundaries, and the evidence for domain specificity of creativity includes both specificity in the sense of broadly defined cognitive domains (e.g., linguistic, mathematical, musical) and more narrowly defined (and more numerous) task or content domains (e.g., poetry-writing, story-writing, collage-making). The latter are what some prefer to call "micro-domains" (Karmiloff-Smith, 1992), and this kind of specificity is sometimes termed "task specificity" (see especially Baer, 1993) rather than domain specificity. Other domain-specific theories of creativity are Gardner's (1983) several "intelligences" and the "domain-relevant skills" of Amabile's (1982, 1996) componential theory (which also includes a general "creativity-relevant skills" component, as explained in the text).

[2] Guilford's (1967) model proposed a multi-dimensional structure of creativity, but at the same time assumed content generality.

[3] Although there are two forms—verbal and figural—of the most popular creativity test, the Torrance Test of Creative Thinking, these tests were viewed as alternate means of assessing the same underlying skills (Plucker, 1998; Torrance, 1974).

The degree to which creativity is domain-specific or domain-general remains hotly contested, but there is at least one area of agreement: people have different creativity profiles. Even those who argue for the existence of domain-transcending, all-purpose creative-thinking skills recognize that people's creativity varies across domains (e.g., Amabile, 1996; Anderson, Reder, & Sitnon, 1996; Conti, Coon, & Amabile, 1996; Plucker, 1998). Perhaps looking at those profiles will yield clues to the structure of creativity and help us find what connections there may be between creativity in different domains.

The goal of the present study has not been to settle, or really even enter into, the debate about the generality of creativity. We have instead taken a preliminary look at some self-assessments of creativity (the area in which past research has led us to believe one should find the greatest degree of generality; Plucker, 1998) and their inter-correlations to see what suggestions they might give regarding how different kinds of creativity—creativity in different domains—relate to one another. We have also examined how such self-assessments in diverse domains relate to other measures of cognitive ability and to creativity as measured with a personality scale.

METHOD

Participants

There were 241 participants (62 males, 179 females). There were 180 Caucasians, 17 African Americans, 22 Hispanics, 9 Asian Americans, 1 American Indian, and 6 participants who selected "Other." Six participants elected not to disclose their ethnicity.

The participants were all volunteer undergraduate students from four different universities in an educational psychology course, a tests and measurement course, a biology course, and a history course. Because of anonymity requirements, their actual Grade Point Averages (GPAs) and SAT scores cannot be reported (or compared to their self-reported GPAs and SAT scores).

Materials

Participants were asked to rate their own creativity on a 1-5 Likert scale, from 1 ("Not at all") to 5 ("Extremely"). They were asked to rate their own general creativity, and then their creativity in the following domains: science, managing interpersonal relationships, writing, art, interpersonal communication, solving one's own personal problems, mathematics, crafts (for example, woodworking, sewing, repairing things, building things, cooking, etc.), and bodily/physical movement (for example, dance, sports, etc.). They were also asked to report their grade point average and their Verbal, Quantitative, and SAT scores.

In addition, participants were administered items from the International Personality Item Pool (2001; see Goldberg, 1999). These items are derived to correlate highly with established personality tests. The items selected for use in our "Creative Personality Scale" (CPS) were taken from the items designed to measure the "Creativity" facet of the Hogan Personality Inventory (HPI; Hogan & Hogan, 1995) and items designed to measure "Imagination" from Cattell's Personality Factors Questionnaire (16PF; Russell & Karol, 1994). The complete scale used is presented in Appendix 1. In addition, we present our self-report scale for assessing creativity in different domains in Appendix 2.

RESULTS

Table 1 presents correlations between self-reports of creativity in different domains and the creative personality score. The CPS was significantly correlated with the self-report score for general creativity ($r = .47$, $p < .01$). The self-report score for general creativity was significantly positively correlated with every self-reported score except for mathematics.

To investigate the association between self-report ratings of creativity in different domains, a Principal Components factor analysis was conducted, with Varimax Normalized rotation. As can be seen in Table 2, three factors emerged. The first factor had significant loadings (more than .50) of interpersonal relationships, writing, communication, and solving personal problems. Factor two consisted of art, crafts, and bodily/physical, and factor three consisted of math and science.

Table 3 presents correlations between self-reported GPA and SAT scores and the self-ratings in different domains, the three factors, and the CPS. GPA was significantly correlated with the CPS score and self-reported creativity in science and writing. SAT Verbal scores were significantly positively correlated with the CPS score, self-reported creativity in communication and writing, and the first factor, while the SAT Quantitative scores were significantly correlated with the CPS score, self-report creativity in math, and the third factor.

Correlations were also conducted between the three factors and the creative personality score and self-reports of general creativity. Factor one significantly correlated with the CPS at $r = .42$, $p < .01$; factor two significantly correlated with the CPS at $r = .19$, $p < .01$, and factor three was not significantly correlated ($r = .10$, n.s.). Factor one significantly correlated with self-reported creativity at $r = .44$, $p < .01$; factor two significantly correlated at $r = .54$, $p < .01$, and factor three was not significantly correlated ($r = .07$, n.s.).

A one-way ANOVA was conducted for ethnicity and every variable (all self-reported creativity scores, the CPS, self-reported GPA and SAT scores, and the

Table 1. Correlations between Self-Reports of Creativity in Different Domains and Creative Personality Score

	Science	Inter-personal relationships	Writing	Art	Inter-personal communication	Solving personal problems	Math	Crafts	Bodily/ physical	Creativity in general
Creative personality	.23**	.27**	.52**	.25**	.33**	.19**	.08	.05	.13*	.47**
Science		.08	.06	.09	–.02	.05	.41**	.12	.05	.21**
Interpersonal relationships			.31**	.12	.60**	.35**	.02	.14*	.16*	.38**
Writing				.20**	.27**	.19**	–.11	–.03	.08	.44**
Art					.07	.11	.07	.44**	.17**	.52**
Interpersonal communication						.45**	–.02	–.03	.05	.33**
Solving personal problems							.14*	.07	.03	.27**
Math								.10	.07	.04
Crafts									.22**	.35**
Bodily/physical										.35**

*Significant at $p < .05$. **Significant at $p < .01$

Table 2. Varimax Normalized Rotated Factors Based on a Principal Components Analysis for Self-Report Creativity in Different Domains

	Factor One	Factor Two	Factor Three
Communication	.850*	–.058	–.029
Interpersonal relationships	.798*	.152	.033
Solving personal problems	.673*	–.004	.208
Writing	.539*	.168	–.167
Crafts	–.034	.801*	.116
Art	.112	.778*	.042
Bodily/physical	.089	.536*	.014
Math	–.010	.035	.857*
Science	.035	.101	.785*
Eigenvalue	2.27	1.61	1.29
% of total Variance	23.6	17.7	16.0

*Loadings > .400 are highlighted with an asterisk.

factor scores). The only variable to show a significant effect was self-reported creativity in science [$F(5, 229) = 2.32$, $p < .05$], but subsequent Tukey Honestly Significant Differences test for post-hoc comparison of means did not reveal any specific difference.

There were, however, several significant differences by gender. Males received a higher overall CPS [$F(1, 239) = 7.49$, $p < .01$] and reported higher SAT Quantitative scores [$F(1, 122) = 8.22$, $p < .01$]. In addition, males rated themselves higher in creativity in science [$F(1, 239) = 20.96$, $p < .01$], writing [$F(1, 239) = 6.15$, $p < .05$], and math [$F(1, 239) = 6.92$, $p < .01$].

To see if these differences made an impact on correlations with overall creativity, separate correlations were computed for these variables for males and females. For males, creativity in science and writing was significantly correlated with CPS ($r = .36$, $p < .01$ and $r = .59$, $p < .01$, respectively) and overall self-reported creativity ($r = .29$, $p < .05$ and $r = .60$, $p < .01$, respectively).

Table 3. Correlations between Self-Reports of Creativity in Different Domains, Factor Scores, Creative Personality Score, Self-Reported GPA, and Self-Reported SAT Scores

	GPA	SAT-Verbal	SAT-Quantitative
Creative personality	.19*	.36*	.32*
Communication	.10	.24*	.12
Interpersonal relationships	.07	.11	.01
Solving personal problems	.01	.05	−.03
Writing	.21*	.30*	.08
Crafts	−.00	−.06	.08
Art	.07	−.03	.02
Bodily/physical	−.00	−.10	.04
Science	.17*	−.08	.20
Math	.03	−.03	.31*
General	.11	.15	.10
Factor One	.12	.24*	.05
Factor Two	.04	−.07	.04
Factor Three	.08	−.09	.26*

*Marked correlations are significant at $p < .05$.

Math was not correlated with either the CPS ($r = .12$, n.s.) or self-reported creativity scores ($r = .10$, n.s.). For females, creativity in science was not significantly correlated with CPS score ($r = .12$, n.s.), but was significantly correlated with self-reported creativity ($r = .16$, $p < .05$). Creativity in writing was correlated with both the CPS score and self-reported creativity ($r = .47$, $p < .01$ and $r = .38$, $p < .01$, respectively), and creativity and math was correlated with neither the CPS ($r = .03$, n.s.) or self-reported creativity scores ($r = .00$, n.s.).

DISCUSSION

When asked to assess their own creativity in different domains, students tended to be consistent; if they viewed themselves as generally creative, they also viewed themselves as creative in different areas. The only area that was not correlated with general creativity ratings was mathematics (and, for females, science). The only factor that was not correlated with self-reported general creativity and a creative personality score was a math and science factor.

Why might this be the case? Mathematics and science may not fall into people's conceptions of creativity—they simply may not consider math to be an area in which to be creative. This idea would be consistent with Paulos's (1988) idea of innumeracy, the inability to accurately use numbers and chance. "Romantic misconceptions about the nature of mathematics," Paulos wrote, "lead to an intellectual environment hospitable to and even encouraging of poor mathematical education and psychological distaste for the subject and lie at the base of much innumeracy" (1988, p. 120). Perhaps we should not be surprised to find that a society that does not value mathematical ability also does not associate creativity with mathematics.

The CPS was found to significantly correlate with student self-reported general creativity, lending some additional construct validity to the idea of using personality scales to measure creativity. The creative personality scale also significantly correlated with reported GPA and SAT Verbal and Quantitative scores, consistent with past studies of creativity and achievement and ability (e.g., Barron & Harrington, 1981). GPA significantly correlated with self-reported creativity in science and writing. SAT Verbal scores significantly correlated with self-reported creativity in communication and writing and the first factor. SAT Quantitative significantly correlated with self-reported creativity in math and the third factor.

Three factors emerged from a factor analysis of the domain ratings. The first factor, consisting of interpersonal relationships, writing, communication, and solving personal problems, could be an "empathy/communication" factor. All of these domains involve the ability to creatively juggle feelings and thoughts, and a knowledge of how to interact with yourself or other people. The second factor, a more "hands on" factor, consisted of art, crafts, and bodily/physical. These domains involve more physical agility and hand-eye coordination. The final factor consisted of math and science, and may include spatial visualization skills or analytic abilities. Until further work is conducted with more domains (such as specific sciences), additional speculation seems premature. It is worth noting that the first factor was the most associated with scores on the CPS, while the third factor was not significantly associated at all.

Our results speak to the subjective structure of creativity: how people experience their own creativity, and especially how their self-perceptions suggest patterns related to their creativity in diverse domains. These implicit conceptions of creativity have power because they influence how people think about and

judge their own creativity and that of others (Runco, 1990; Sternberg, 1985), although these implicit understandings of what creativity is may or may not coincide with the actual structure of creativity in terms of underlying cognitive mechanisms (Kaufman & Baer, 2004). We believe that these results help us better understand the experiential structure of creativity and add to our understanding of what general, domain general creativity means to many people. Among the college students who were our subjects, it appears that "being creative" in general means, essentially, being creative in many things, but with the interesting exception of mathematics.

Our findings further suggest that while a personality scale designed to measure creativity does show a significant relationship with such academic indicators as GPA and SAT scores, self-reported general creativity does not. Perhaps students' perceived general creativity is not related to their knowledge of their achievement and academic abilities.

Our results support past self-report creativity research in showing that creativity is perceived as much more general than is suggested by the results of performance assessments of creativity. This generality may not be quite monolithic, however; there appear to be at least two general areas of creativity (math and everything else) and possibly three (that is, the three factors described above that emerged from our analysis).

It is important to note that these are all self-report findings, and therefore the structure of creativity that they suggest is only reflective of people's beliefs about creativity (and by "people" we recognize that we are really talking about college students, who made up our entire sample). People's beliefs about creativity may be (and probably are) different than the underlying structure of creativity; people's conceptions and self-perceptions related to the structure of creativity probably do not very closely match the actual cognitive mechanisms that contribute to creativity in different domains or the ways these mechanisms interact to influence and shape creativity in those diverse domains.

In addition, there are limitations inherent in this sample that caution to overgeneralize the results. Our self-report scores were based on single questions, which may cause reliability concerns.

As noted in our introduction, different ways of answering the question of how general or domain-specific is creativity have tended to find different answers. This should not surprise us; there is probably no single correct answer to the question, "What is the structure of human creativity?" but rather multiple overlapping answers, as there are in the area of human intelligence (Sternberg, 1990). These different answers can tell us different truths—for example, what is the internally experienced subjective structure of creativity, what are the cognitive mechanisms that underlie creative performance, or what skills and attitudes lead to creativity in different domains. The answers that come from asking these different questions can also help guide future research not only in finding better answers to the specific questions asked about the structure of creativity, but also in providing

hypotheses for researchers asking different questions about the nature, internal organization, or components of human creativity.

APPENDIX 1
Creative Personality Scale

On the following pages, there are phrases describing people's behaviors. Please use the rating scale below to describe how accurately each statement describes *you.* Describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age. So that you can describe yourself in an honest manner, your responses will be kept in absolute confidence. Please read each statement carefully, and then fill in the bubble that corresponds to the description on the scale.

	Very Inaccurate	Moderately Inaccurate	Neither Inaccurate nor Accurate	Moderately Accurate	Very Accurate
Do things that others find strange	O	O	O	O	O
Like to get lost in thought	O	O	O	O	O
Enjoy wild flights of fantasy	O	O	O	O	O
Do things by the book	O	O	O	O	O
Love to daydream	O	O	O	O	O
Swim against the current	O	O	O	O	O
Like to solve complex problems	O	O	O	O	O
Am not interested in abstract ideas	O	O	O	O	O
Love to read challenging material	O	O	O	O	O
Seldom get lost in thought	O	O	O	O	O
Have a vivid imagination	O	O	O	O	O
Know how things work	O	O	O	O	O
Am not interested in theoretical discussions	O	O	O	O	O
Seldom daydream	O	O	O	O	O
Take deviant positions	O	O	O	O	O
Try to avoid complex people	O	O	O	O	O
Avoid difficult reading material	O	O	O	O	O
Do unexpected things	O	O	O	O	O
Do not have a good imagination	O	O	O	O	O
Love to think up new ways of doing things	O	O	O	O	O

APPENDIX 2
Creativity Scale for Different Domains

Using the scales given, please rate your own creativity in the indicated domains.

	Not at all	A little	About average	Very	Extremely
How creative are you in the area of science?	O	O	O	O	O
How creative are you in the area of managing interpersonal relationships?	O	O	O	O	O
How creative are you in the area of writing?	O	O	O	O	O
How creative are you in the area of art?	O	O	O	O	O
How creative are you in the area of interpersonal communication?	O	O	O	O	O
How creative are you in the area of solving your own personal problems?	O	O	O	O	O
How creative are you in the area of mathematics?	O	O	O	O	O
How creative are you in the area of crafts (for example, wood-working, sewing, repairing things, building things, cooking, etc.)?	O	O	O	O	O
How creative are you in bodily/physical movement (for example, dance, sports, etc.)?	O	O	O	O	O
How creative would you say you are in general?	O	O	O	O	O

ACKNOWLEDGMENTS

The authors would like to thank David K. Hecht, Allison B. Kaufman, and the CSUSB students of Psychology 377 for assistance with data collection.

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