

# 行政院國家科學委員會專題研究計畫 成果報告

## 創造力相關變項效應量之後設分析

計畫類別：個別型計畫

計畫編號：NSC94-2413-H-004-007-

執行期間：94年08月01日至95年07月31日

執行單位：國立政治大學教育學系

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報告類型：精簡報告

處理方式：本計畫可公開查詢

中 華 民 國 95 年 11 月 1 日

## The Effect Size of Antecedents and Correlates of Creativity: A Meta-Analysis

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The purpose of the present study is to investigate the effect size of the antecedents and correlates of creativity including cognitive abilities, personality characteristics, motivation, and background experiences.

In the literature of creativity research three directions can be identified: (a) to find the association of creativity with cognitive ability and/or with personality, (b) to determine the organizational factors that nurture or inhibit creativity, and (c) to evaluate the effectiveness of creativity training. (Basadur, Graen, & Green, 1982)

In the evaluation of the effectiveness of creativity training programs, there have been some studies intended to synthetically analyze the overall effectiveness by means of narrative review (Mansfield, Busse, & Krepelka, 1978; Torrance, 1972) or quantitative meta-analysis (Ma, in press; Miga, Burger, Hetland, & Winner, 2000; Rose & Lin, 1984; Scope, 1998; Swanson, & Hoskyn, 1978). However there is still no meta-analysis investigating the correlates of creativity without training. Hinton (1970) found that of the forty variables, thirty-seven measuring personality factors, and three measuring ability factors, twenty had significant correlations with creative problem solving performance. Guilford (1971) argued that divergent thinking abilities should not be expected to correlate very highly with other criteria of creative potential.

Is a creative person likely to be field-independent, self-determination, highly intelligent or highly achieved? It would be helpful in the recruitment of creative personnel if association of creativity with personal traits and/or with cognitive abilities is identified. The purpose of the present study is to investigate the size of the correlation between the creativity and intelligence, personality, cognitive ability, school performance and achievement.

In the literature it can be found that there are two aspects of creativity, one is the ideation without evaluation, and the other the ideation with evaluation. Torrance Tests of Creative Thinking is the most popular instrument to be used in the measurement of the former category, while problem solving belongs to the latter category. Each category has its own measurable indicators. Averill (1999) had distinguished three facets of emotional creativity: preparedness, novelty, and effectiveness/authenticity and explored empirically their correlations with personality traits and cognitive abilities.

Creativity has been defined in terms of three Ps: the creative person, the

creative process, and the creative product by some researchers (Han, 2000).

The creative person is referred to personality, demographical characteristics, cognitive styles, thinking styles, motivation, attitude, and other specific personal characteristics related to creativity. For the personality, the five broad dimensions of personality proposed by Digman (1990) was useful. The so-called Big Five personality dimensions contains emotional stability versus neuroticism, introversion versus extraversion, satisfaction with the familiar versus openness to experience, hostility versus agreeableness, and indifference versus conscientiousness.

Neuroticism implies an unusualness of response but neurotic behavior is ineffective (Averill, 1999). Wolfradt and Pretz (2001) discovered in their literature reviews that there were contradictory findings concerning the relationship between creativity and neuroticism. While Götz and Götz (1979) found that the correlation of neuroticism with creativity was negative in sciences, but positive in arts, other researchers did not find a significant correlation between them (e.g., Eysenck & Furnham, 1993).

“Adjective Check List” is not an instrument to measure the creative ability but the creative personality. Therefore, it was assigned to the category of creative person. Sternberg and Lubart (1995) have proposed six resources nurturing creativity: intelligence, knowledge, thinking style, personality, motivation, and environment. With the exception of environment, the other five resources belong to the category of creative person. Environment was regarded by Rhodes (1961) as the 4<sup>th</sup> P, i.e., press (context). Runco, Nemiro, and Walberg (1998) label this 4<sup>th</sup> factor as place. Cognitive preferences were not regarded as cognitive styles and excluded from the present study because Palaniappan (1998) had found that they were not correlated with creativity and its components.

The creative process is similar to the process of problem-solving. In the present study, it was described in five steps: (1) defining problem, (2) retrieving problem-related knowledge, (3) generating potential solutions, (4) generating criteria for evaluating appropriate solution, (5) selecting solution and implementing. Defining problem has the same meaning with problem construction stated by Reiter-Palmon, Mumford, Boes, & Runco, 1997). They defined the problem construction as to restate the problem as many different ways as possible before begin to solve the problem; retrieving problem-related information is parallel to information encoding noted by Mumford, Baughman, Supinski, & Maher (1996); generating potential solutions is equivalent to category selection (Mumford, Mumford, Supinski, Threlfall, & Baughman,

1996); generating criteria for evaluating appropriate solution is similar to identifying valuation criteria (Parnes & Treffinger, 1973); while selecting solution and implementing is the last step of problem-solving which may include a process of category combination as remarked by Mumford, Baughman, Maher, Costanza, & Supinski (1997) or reorganization of knowledge according to the complexity of the problem. The cycle of this five steps of problem-solving process may recur if the selected solution does not work.

The function of incubation might be that it provides the individual who has worked hard on a problem an opportunity to reorganize consciously the learned knowledge or let his knowledge self-organize generated.

A result of Diakidoy & Constantinou's (2000-2001) study showed that the number of valid responses that students could give to ill-defined physics problems could significantly predict the response originality on the explanation and prediction problems. This indicates that the domain-specific conceptual knowledge might be a prerequisite, though not necessarily sufficient condition for the domain-specific creative problem-solving.

The creative product concerns itself with generated ideas, solutions, performances, or products. Creative product was measured in terms of fluency, flexibility, elaboration, originality, quality, etc.

These four Ps of creativity were used in the present study as a main framework of classification of variables related to creativity.

Quality of solution in problem solving was included in the variable list because Quality of solution in problem-solving is conceptually and empirically different from originality of solution. Norlander & Gustafson's (1996) experimental study asking the subjects to plan an experiment to investigate the relative importance of heredity and environment showed that acute alcohol intoxication did produce significantly more incubations and significantly higher levels of originality, but no significant difference in scientific value between the Alcohol group and the Placebo or Control group was found in their study. While the originality of a solution is creative, the quality of a solution is both creative and practical. Parnes & Treffinger (1973) also emphasized that the genuine creativity must be adaptive to reality.

Conforming and cooperative characteristics are ordinarily linked with noncreative behavior (Runco & Johnson, 2002)

Although divergent thinking and schizophrenic disorder have similar definitions, it is hard to equate divergent thinking with psychotic thinking, and Guilford himself insisted that creative thinking is essentially rational

(Schuldberg, 2000-2001, p. 7). Schuldberg's (2000-2001) study showed that among the correlation coefficients between the subclinical psychopathological traits and the Richards Maximum of the Peak Vocational and Avocational Creativity, there was one significant positive correlation ( $r = .17, p < .05$ ), two significant negative correlations ( $r = -.34, p < .01$  and  $r = -.16, p < .05$ ), and the rest four coefficients were not significant ( $r = -.02, -.05, .08, \text{ and } -.10$ ). In the present study, it is postulated that creativity has positive correlation with emotional stability and negative correlation with neuroticism..

The three stages processes of problem solving was proposed by Basadur, et al. (1982). They postulated that ideation and evaluation may oscillate each of three stages of the whole creative problem-solving process.

In the problem solving, the fluency is defined as "the ability to enumerate many ideas related to the problem," flexibility is defined as "the ability to shift readily among several kinds or classes of ideas and solutions" (Parnes & Treffinger, 1973, p.8). Elaboration is needed in order to increase the acceptability and attraction of the solution or the newly designed product.

In addition to the general concepts of creativity including domain-free verbal and figural creativity as well as domain-specific creativity, such as creativity in art, science, etc., two other kinds of creativity were explored, one was emotional creativity and the other was motor creativity. Trevlas, et al. (2002) investigated the relationship between playfulness and motor creativity. They measured motor creativity on two dimensions: motor fluency and motor flexibility. Motor fluency was calculated by summing different movement responses and motor flexibility was the number of thematic changes, such as effort space, relationship, etc.

### *Method*

#### *Data collection of the study.*

The ProQuest Educational Journal, ProQuest Dissertation Consortium, and ERIC databases will be scanned for researches investigating correlates of creativity. The term used was "creativity and intelligence", "creativity and personality," and "creativity and cognitive ability." "Journal of Creativity Behavior," and "Creativity Research Journal," will be systematically, manually searched. Additionally some usable empirical articles were traced from the references of research papers in other related journals. Studies measuring creativity by means of intuitive self-rating or teacher rating on a Likert scale without basing on creativity work or task were excluded from the present meta-analysis because the imprecise measurement based on an

amorphous feeling of the rater would contaminate the results. Also excluded from the present study were those studies reporting only significant correlation coefficients because omitting the non-significant correlation coefficients would inflate mean effect sizes. However, studies using an inventory to measure attitude or personality by means of a Likert scale were tolerated and included in the present study.

*Coding procedure*

When component scores and total score were both available, total score was ignored, in order to avoid redundancy. If a variable was negatively correlated with the creativity, in order to avoid canceling out the effect sizes of other variables, which had positive correlations with creativity, the sign of its correlation was changed and simultaneously the name of this variable was changed into a positive name. E.g., neuroticism was negatively correlated with emotional creativity. So the name of this variable was changed into emotional stability and the sign of correlation coefficient was also changed into positive sign.

Table 1

*Definition of Independent Variables of Creativity*

Coding number	Definition of independent variables
1	Achievement tests (including California Achievement Test and Scholastic Aptitude Test; Graduate Management Admission Test; Lorge-Thorndike: Verbal and quantitative; college vocabulary
2	School performances (including Grade Point Average, Accomplishment Checklist, Academic Success scores, Core knowledge (1) vs. non-core knowledge curriculum (0), story writing, oral narrative tasks; classroom performance rating of student teacher;
3	Cognitive ability (including IQ Test; WISC-III Vocabulary; Raven's Cognitive Reasoning Test; Metaphoric Comprehension; Lunzer Test ; Wisconsin Card Sorting Test;
4	Non-alexithymia (ability to identify and describe one's own emotional feeling); Empathy (ability to detect and describe feelings of others)
5	visual imagery capacity (measured by Vividness of Visual Imagery Test for Teenagers); fantasy; imaginativeness in play;
6	Humor (Word-Play; Joke)
7	Creative personality: Adjective Check List(Creative Personality Scale); <del>How Do You Think (measuring creative personality interests attitude</del>

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- How Do You Think (measuring creative personality, interests attitude, and self-perception ); Barron-Welsh Revised Art Scale(which was developed by contrasting the responses of artists and nonartists of their preference for black-and-white doodles); Personality in terms of a creative attitude; Torrance Leisure Interest checklist; Golann Forced Choice Questionnaire; SEEK dimension of Panksepp's Affective Neuroscience Personality Scales
- 8 High scores of emotional stability and low scores of neuroticism; low anxiety; low social anhedonia (social withdrew);
- 9 High scores of extraversion (socially outgoing and adept) and low scores of introversion; Seeking social support in coping stressful situation (talking to someone to find out more about the situation); Myers-Biggs type indicator of personality (extroverted, intuitive, feeling and perceiving);
- 10 Openness to experience as opposed to Satisfaction with familiar; Nonconformity to school discipline; quest religious orientation (having an open attitude toward issues of fundamental concern of existence); Non-authoritarianism (not adhering to received custom and authority); non-extrinsic religious orientation (not focusing on external rewards, not accepting the religion as a means to self-serving ends, such as security and social status); Non-intrinsic religious orientation (being not true believers);
- 11 Agreeableness (compassionate, good-natured, and cooperative) as opposed to Hostility (proud, skeptical, and competitive); non-confronting coping (attempts to alter the situation not through hostile or risk-taking activity); coping stressful situation not with confrontation;
- 12 Conscientiousness (well-organized, disciplined, achieve oriented) as opposed to Indifference (easygoing or detaching oneself emotionally from the situation)); Moral Maturity; coping stressful situation not with distancing but getting serious about it; Accepting one's own responsibility for stressful situation;
- 13 General mysticism (emphasizing the transcendental experience, and having a sense that all things are alive); Religious mysticism (emphasizing the holiness or sacredness of an experience)
- 14 Cognitive styles: high scores of field-independent and low scores of field dependent);
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- 15 Willingness to take risks; Category width;
- 16 Self-efficacy: having a faith in one's own abilities); Self-esteem; autonomy; Self determination; Self-directing religious coping style (stressing one's own power to deal with problems without God' help); Internal locus of control (believing that life events are largely under internal or personal control instead of external control such as powerful others or chance); Non-collaborative religious coping style (not viewing both God and the self as active contributors, working together to solve problems but self-directed); Non-deferring religious coping style (not placing responsibility for problem solving on God); Self-controlling (emphasizing control over one's own behavior and the situation, whether through individual or collective action); Making planful problem-solving in coping stressful situation (deliberate and analytic approaches to solving the problem); Not choosing escape-avoidance in coping stressful situation; Self-concept;
- 17 Prior traumatic experience:
- 18 Class climate favorable for creativity (Competitiveness between peers in achievement; competition > no competition; low friction among students; low cohesiveness between students, Satisfaction with class climate; low difficulty of class work); Teacher encourages creativity, including self-initiated learning, self-evaluation, manipulate materials, open discussion; instruction condition (algorithmic (providing a rote step-by-step algorithm for building a sample structure) > heuristic (demonstrating the same techniques in a more flexible form)); nominal group by brainstorming(exchange of written ideas or using computers)> interactive group brainstorming; anonymous > identified in electronic brainstorming;
- 19 Alcohol-free; quiet working circumstance; Work setting with complexity of visual detail, natural view and natural material, less use of manufactured or composite surface materials, and with fewer cool colors used; No limits or informational limits during creative activities was better than controlling limits; Free-play with salt dough before taking creativity test;
- Systematic-relaxation exercises versus unsystematic resting or music hearing; playfulness including physical spontaneity, social spontaneity, cognitive spontaneity, manifest joy, and sense of humor;
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20	Instructing the subjects to be flexible or original on testing; test instruction included nonverbal illustrations of model responses
21	Inclination for divergent thinking (including preferences for high ideation/low evaluation, high intuition/low reasoning, and high innovation/low adaptation, explorer>assimilator cognitive style; high ambiguity tolerance);
22	Inclination for convergent thinking (including preferences for evaluation, reasoning, and adaptation, intolerance for ambiguity)
23	High scores of Intrinsic motivation and low scores of extrinsic motivation (bonus; Ss were told that their tasks would be evaluated); constructive feedback (provide the information about the strength of students' collage); intrinsic religious motivation
24	Prestige of Honors/Awards (including National Academy Membership, Professional Visibility
25	Age (grade level)
26	Gender (male=0; female=1)
27	Leadership; Transformation leadership (leader promotes innovation, motivation, and expression of different viewpoints of group members)
28	Psychological Androgyny (having high scores on both femininity and masculinity)
29	Birth order; number of siblings
30	Non-delinquent

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Table 2

*Definition of Dependent Variables*

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Classification	Definition of dependent variables
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Ideation without evaluation	<p>Composite score of creativity: Total score of two or more components of creativity; creativity test score without mentioning specific component, such as stories or poems writing; collages; divergent thinking performance (generating phrases of words starting with given letters, titles for a short story, consequences of not having things, unusual uses for common items, groupings of items on a list, and completions of stem analogies); Wallach &amp; Kogan Creativity Test (verbal); Test for Creative Thinking-Drawing Production; Purdure Creativity Test; numeric creativity</p>
	<p>Nonverbal creativity: figural production; symbolic production; collages ; Polygon figure-preference test; Wallach &amp; Kogan Creativity Test (nonverbal); Portfolio of photographs rated by professionals;</p> <p>Fluency: ability to produce a large number of ideas.</p> <p>Flexibility: ability to produce a wide variety of ideas.</p> <p>Elaboration: ability to develop or embellish ideas and to produce many details.</p> <p>Originality: ability to produce unusual ideas; unusualness; uniqueness;</p> <p>Nonverbal Fluency: ability to produce a large number of ideas; motor fluency</p> <p>Nonverbal Flexibility: ability to produce a wide variety of ideas; motor flexibility</p> <p>Nonverbal Elaboration: ability to develop or embellish ideas and to produce many details</p> <p>Nonverbal Originality: ability to produce unusual ideas ; unusualness ; uniqueness</p>
Ideation with evaluation (Problem solving)	<p>Abstractness of titles</p> <p>Resistance to premature closure; overcoming fixation;</p> <p>Composite score of problem solution; convergent thinking performance (to perform task with analysis, linear reasoning, and evaluation of ideas); creativity of the product; Wallach &amp; Kogan Creativity Test (problem solving); Remote Association Test; Creativity of publications; Social problem-solving(social creativity) ;</p>

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Performance-based Assessments (story-telling, Collage-making, math problem); Scientific creativity; Statement of Past Creative Activities ; Creative Activities List ; Vaughan Test of Musical Creativity Composite ; painting products

Fluency of solution (Number of non-redundant solutions)

Flexibility of solution (number of categorical shifts made in solutions)

Elaboration of solution (details included in each solution; attractiveness of the product; Interest of the product)

Originality of solution (The novelty of solution); evaluation of originality

Quality of solution (appropriateness of a solution to solve a problem), It includes Effectiveness of solution (Did the solution succeed in solving the problem?); evaluation of appropriateness; technical quality of product; composition, technical quality of product; likeability

Emotional  
creativity  
(Emotional  
Creativity  
Inventory,  
developed  
by Averill,  
1999)

Emotional creativity (total score as measured by Emotional Creativity Inventory)

Preparedness: understanding and learning from one's own and other's emotions.

Novelty: ability to experience unusual emotions

Effectiveness and authenticity: the skill to express emotions adroitly and honestly and it leads to potential benefit to the individual or group.

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For the measurement of the effect size of age on creativity, the correlation between the age and creativity scores was preferred. However, if

the correlation was not available and instead, means, sample sizes, and standard deviations were presented, then the data of the lowest grade level or age were used as the data of control group and the other to be compared group as experimental group. For example, in Cheung, et al.'s (2004) study, grade 1 was used as the control group for grade 2 and 3, whereas grade 4 was used as control group for grade 5 to 9, because grade 1 to 3 were individually tested and grade 4 to 9 were tested in group.

In the study conducted by Charles and Runco (2000-2001), there was a correlation coefficient of 1.00. It was changed to .99 in the present study to let it convertible into an effect size.

If a composite score of creativity was derived from its elements, then the correlations between the composite and the elements were not included the calculation of effect size.

The most difficult work in the meta-analysis is the categorization of variables. During the process of encoding, combination and reorganization had to be carried out because of occurrence of new variables

#### *Calculation of effect size*

Effect sizes were calculated from  $r$  and the means and standard deviations of performance outcome of comparative group design. Following Formulas were used in the calculation.

$$(1) \text{ es} = \sqrt{\frac{4(N-1)}{N}} * \sqrt{\frac{r^2}{1-r^2}}$$

(Hedge & Olkin, 1985, P.77). Where  $N$  is the sample size, and  $r$  is the correlation coefficient when both variables are continuous.

$$(2) \text{ es} = \frac{M_e - M_c}{\sqrt{\frac{(n_e - 1)SD_e^2 + (n_c - 1)SD_c^2}{n_e + n_c - 2}}}$$

Where  $SD_e$  is the standard deviation of experience group;  $n_e$  and  $n_c$  are the sample size of experimental and control group respectively. Formula (2) was used for the result in which both the standard deviation of the experimental and control groups were available.

$$(1) \text{ es} = \frac{M_e - M_c}{SD_c}$$

Where  $es$  = effect size of a single experimental;  $M_e$  and  $M_c$  is the mean of the experimental and control group respectively.  $SD_c$  is the standard deviation of the control group. Formula (1) was used for the result in which only the standard deviation of the control group was available.

$$(2) \quad es = \frac{M_e - M_c}{\sqrt{\frac{(n_e - 1)SD_e^2 + (n_c - 1)SD_c^2}{n_e + n_c - 2}}}$$

Where  $SD_e$  is the standard deviation of experience group;  $n_e$  and  $n_c$  are the sample size of experimental and control group respectively. Formula (2) was used for the result in which both the standard deviation of the experimental and control groups were available.

Effect sizes were calculated from the means and standard deviations of performance outcome of experimental and control groups, or by converting value of other statistical tests, such as  $r$ ,  $t$ ,  $F$ ,  $\chi^2$  or  $Z^2$ . Following Formulas were used in the calculation.

$$(3) \quad es = \sqrt{\frac{4(N-1)}{N}} * \sqrt{\frac{r^2}{1-r^2}}$$

(Hedge & Olkin, 1985, P.77). Where  $N$  is the sample size, and  $r$  is the correlation coefficient when both variables are continuous.

$$(4) \quad es = \frac{t(n_e + n_c)}{\sqrt{n_e n_c (n_e + n_c - 2)}}$$

Where  $t$  is the value of t-test.

$$(5) \quad es = \frac{2\sqrt{F}}{df}$$

Where  $\sqrt{F}$  is the square root of  $F$  value and  $df$  is the degree of freedom of the numerator of  $F$  ratio. Only the  $F$  ratios with one degree of freedom in the denominator were included in the present analysis.

Formulas (4)-(5) are cited from Cooper & Hedges(1994, P.232-239).

$$(6) \quad es = \frac{Me_2 - Mc_2}{SDc_2} - \frac{Me_1 - Mc_1}{SDc_1}$$

Where  $Me_2$  and  $Mc_2$  are the mean of posttest the experimental and control

group respectively.  $Me_1$  and  $Mc_1$  are the mean of pretest of the experimental and control group respectively.  $SDc_2$  and  $SDc_1$  are standard deviation of posttest and pretest of control group respectively. Formula (9) was used for result of experimental design with pre- and posttest (Wortman & Bryant, 1985). This formula was also employed by Gersten & Baker (2001). Goff (1992) used analysis of covariance to statistically control the pre-test difference in comparing the difference of post-test means between the experimental and control groups. This supports the legitimacy of taking into account the difference of pre-test scores between the experimental and control group in the calculation of effect size of post-test scores for the experimental design with pre- and post-test.

Formula (1) - (6) have taken sample size into consideration, because the significance of effect size could be influenced by sample size (Fan, 2001). According to Fan's simulation. An effect size of .8 might have 99.95% chance of significance under  $N=240$ , but might have only 37.25% of statistically significant tests under  $N=20$ .

Table 1 shows that value of different statistical tests, such as  $r$  ,  $Z^2$  ,  $F$  ,  $\chi^2$  and  $t$  were converted to effect sizes. There were seven studies with 71 measures. To determine whether the 71 effect sizes were significantly different from zero, t-test was employed. It was found that the average effect size ( $ES=0.69$ ) was significant,  $t_{(70)}=12.45$  ,  $P<.0001$ . The t value was calculated with formula (10).

$$(10) \quad t = \frac{ES - 0}{\sqrt{\frac{SD}{k}}}$$

Where ES and SD are the average mean and standard deviation of the effect sizes respectively, and k is the number of effect sizes (here,  $k=71$ ) .

In order to exclude the possible dependency of measures, effect sizes of a single student were averaged.

## Results

Fantasy is central to creativity, it is inferred that people with psychopathically fantasy would be more creative (Domino, et al., 2002).

Because the high-creative and low-creative groups in Domino, et al.'s (2002) study were formed by means of the highest and lowest 25% of composite T

scores of Adjective Check List, Torrance Tests of Creative Thinking, Barron-Welsh Revised Art scale, The Similes Test, and Haiku poetry, and the ego defense styles, the dependent variables, were measured with depth interview. Their methodology was different from other studies since the based their grouping on creativity measurement as well as creative personality, and the reliability of depth interview measuring ego defense styles was low, therefore their study was also picked for special analysis. The definitions of 15 ego defense styles were referred to Domino, et al. (2002).

The data singled out for special description were too infrequent for statistical purposes and thus were dropped from further consideration.

The 95% confidence intervals are presented along with effect size. According to Cohen's criteria, approximately an effect size of 0.2 is small, 0.5 is medium, and 0.8 is large (Cohen's, 1977, p. 44), and a correlation of .10 has a small, .30 a medium, and .50 a large effect size (Cohen, 1988).

Because the significance of the correlation coefficients depends on the sample size, it is hard to average a correlation coefficient of .8 with n=3 and a correlation coefficient of .2 with n=80. Therefore r will be converted to effect size in the present study.

Table 3

*Effect sizes of the Three Categories of Dependent Variables*

Category	k	Mean rank	Mean	SD
Divergent creativity	737	549.42	.36	.54
Problem-so lving creativity	235	563.13	.34	.52
Emotional creativity	128	533.53	.32	.41
Total	1100		.35	.52

Using Kruskal-Wallis test, the difference between the mean ranks of the three categories of dependent variables was not significant,  $\chi^2(2, N = 1100) = .75, p > .05$ .

Table 4  
*Effect sizes of the Subcategories of Dependent Variables*

Variable	k	Mean rank	Mean	SD	
Problem solving elaboration	16	7	779.43	0.58	0.25
Divergent composite nonverbal	2	37	601.50	0.55	0.69
Divergent fluency	3	149	615.28	0.44	0.49
Divergent elaboration	5	69	563.76	0.41	0.64
Problem solving fluency	14	25	604.02	0.41	0.47
Emotional creativity preparedness	20	40	607.42	0.41	0.34
Divergent elaboration nonverbal	9	143	567.36	0.40	0.52
Problem solving quality	18	20	652.55	0.40	0.47
Emotional creativity effectiveness	22	40	565.28	0.37	0.37
Problem solving composite	13	121	547.03	0.34	0.59
Divergent composite	1	196	557.81	0.33	0.41
Problem solving flexibility	15	13	563.12	0.31	0.47
Divergent flexibility	4	32	479.91	0.30	0.57
Divergent originality	6	14	399.74	0.30	1.02
Divergent fluency nonverbal	7	14	442.96	0.26	0.63
Problem solving originality	17	49	514.64	0.25	0.41
Emotional creativity novelty	21	40	451.85	0.22	0.51
Divergent originality nonverbal	10	30	450.65	0.19	0.37
Divergent abstractness of title	11	9	383.44	0.17	0.11
Emotional creativity total	19	8	413.69	0.17	0.27
Divergent flexibility	8	12	467.13	0.15	0.56

nonverbal					
Divergent resistance to premature closure	12	15	340.07	0.06	0.36
		1100		0.35	.52

Using Kruskal-Wallis test, the difference between the mean ranks of the 22 subcategories of dependent variables was significant,  $\chi^2(2, N = 1100) = 43.71, p < .01$ .

Table 4

*Effect sizes of Independent Variables*

		k	Mean rank	Mean	SD
Prestige of honors/awards	24	3	1068.33	1.39	0.18
Creative working setting	19	28	731.36	.97	1.31
Class climate	18	32	751.36	0.80	0.83
Leadership	27	10	749.10	0.72	0.71
Openness	10	24	697.81	0.71	0.70
Creative personality	7	34	760.00	0.69	0.63
Testing instruction	20	2	866.75	.68	.27
Mysticism	13	6	832.33	0.67	0.31
Non-alexithymia	4	10	731.15	0.65	0.83
Humor	6	2	666.75	0.48	0.45
Nondelinquent	30	8	719.19	0.48	0.18
Prior trauma	17	24	643.69	0.45	0.39
Inclination for divergent thinking	21	8	658.06	0.43	0.25
Cognitive styles	14	4	643.00	0.42	0.28
Androgyny	28	10	606.20	0.40	0.36
Achievement	1	56	570.01	0.36	0.35
School performance	2	154	566.65	0.34	0.43
Extraversion	9	24	545.25	0.32	0.29
Age	25	153	574.82	0.32	0.45
Cognitive ability	3	168	552.25	0.31	0.38
Intrinsic motivation	23	33	522.18	0.30	0.50
Birth order	29	54	475.27	0.30	0.48
Visual imagery capacity	5	9	510.67	0.29	0.29
Conscientiousness	12	19	455.61	0.23	0.33
Self-efficacy	16	46	467.88	0.23	0.33
Inclination for convergent	22	7	434.64	0.20	0.22

thinking					
Agreeableness	11	13	377.88	0.15	0.21
Gender	26	104	426.86	0.14	0.43
Taking risk	15	6	513.92	0.13	0.64
Emotional stability	8	49	369.54	0.08	0.36
Total		1100		.35	.52

Levene test showed that the variances were not homogeneous,  $F(29, 1070) = 6.05$ ,  $p < .001$ , hence non-parametric statistics are suitable for further analyses. Using Kruskal-Wallis test, the difference between the mean ranks of the three categories of independent variables was significant,  $\chi^2(29, N = 1100) = 116.85$ ,  $p < .001$ .

Some conclusions can be drawn from the results:

1. there were no significant differences between the mean ranks of the three categories of dependent variables, i.e., divergent creativity, problem solving creativity, and emotional creativity. The average mean of 1100 effect sizes were 0.35 (a small effect size), with a standard deviation of .52.
2. Among the dependent variables, elaboration of solution of problem-solving and total scores of divergent creativity had effect sizes over .5. They belong to the medium effect size.
3. So far as the independent variables are concerned, prestige of honors or academic awards had the highest rank of effect size (mean effect size was 1.39). The other two variables which had large effect sizes were creative working setting and creative class climate, with a mean effect size of .97 and .80 respectively.

The above conclusions result only in a trial because of the limited number of studies collected. Further relevant studies will be searched in the future.

By the conversion of different statistics to effect size, the present author used the data presented by McCormack (1975) to compare the effect sizes converted from F-value and Mean-value and found that effect sizes converted from F-value were about 1-3% larger than that from mean-value.

#### References

References marked with an asterisk indicate studies included in the meta-analysis.

- \*Alexander P. A., Jetton, T. L., White, S. H., Parsons, J. L., Cotropia, K. K., Liu, H. C., & Ackerman, C. M. (1994). Young children's creative solutions to realistic and fanciful story problems. *The Journal of Creative Behavior*,

28(2), 89-106.

- \*Anastasi, A. & Schaefer, C. E. (1971). Note on the concepts of creativity and intelligence. *The Journal of Creative Behavior*, 5(2), 113-116.
- \*Basadur, M., Graen, G. B., & Green, S. G. (1982). Training in creative problem solving: Effects on ideation and problem finding and solving in an industrial research organization. *Organizational Behavior and Human Performance*, 30, 41-70.
- \*Brophy, D. R. (2000-2001). Comparing the attributes, activities, and performance of divergent, convergent, and combination thinkers. *Creativity Research Journal*, 13(3&4), 439-455.
- \*Bullough V., Bullough B., & Mauro M. (1981). History and creativity: research problems and some possible solutions. *The Journal of Creative Behavior*, 15(2), 102-134.
- \*Christiaans, H. H. C. M. (2002). Creativity as a design criterion. *Creativity Research Journal*, 14(1), 41-54.
- Cohen, J. (1977). *Statistical power analysis for the behavioral sciences*. New York: Academic Press.
- Cropley, A. J. (2000). Defining and measuring creativity: Are creativity tests worth using? *Roeper Review*, 23(2), 72-79.
- \*Davis, G. A. & Belcher, T. L. (1971). How shall creativity be measured? Torrance tests, RAT, alpha biographical, and IQ. *The Journal of Creative Behavior*, 5(3), 153-161.
- \*Doherty, W. & Corsini, D. A. (1976). Creativity, intelligence, and moral development in college woman. *The Journal of Creative Behavior*, 10(4), 276-284.
- \*Domino, G. (1994). Assessment of creativity with the ACL: An empirical comparison of the four scales. *Creativity Research Journal*, 7(1), 21-33.
- \*Feist, G. J. (1997). Quality, quantity, and depth of research as influences on scientific eminence: Is quantity most important? *Creativity Research Journal*, 10(4), 325-335.
- Guilford, J. P. (1971). Some misconceptions regarding measurement of creative talents. *Journal of Creative Behavior*, 5, 77-87.
- Haertel, G. D., Walberg, H. J., & Haertel, E. H. (1981). Socio-psychological environments and learning: A quantitative synthesis. *British Educational Research Journal*, 7, 27-36.
- Hedgers, L.V.& Olkin, I. (1985). *Statistical methods for meta-analysis*. Orlando: Academic Press.
- Hinton, B. L. (1970). Personality variables and creative potential. *The Journal*

*of Creative Behavior*, 4(3), 210-27.

- \*Lopez, E. C., Esquivel, G. B., & Houtz, J. C. (1993). The creative skills of culturally and linguistically diverse gifted students. *Creativity Research Journal*, 6(4), 401-412.
- Ma, H.-H. (2003). Meta-analysis of the effect of creativity training. Project financially supported by the National Science Council (NSC 92-2413-H-004-004)
- Mansfield, R. s., Busse, T. V., & Kreplka, E.J. (1978). *The effectiveness of creativity training. Review of Educational Research*, 48(4), 517-536.
- Miga, E., Burger, K., Hetland, L., Winner. E. (2000). Does studying the arts engender creative thinking? Evidence for near but not far transfer. *Journal of Aesthetic Education*, 34, 91-106.
- \*Ononye, G. C., Blinn-Pike, L. M., & Smith, D. E. (1993). Creativity and future time perspective: exploring fantasy and realistic measures. *Creativity Research Journal*, 6(4), 449-456.
- Parnes, S. J. & Treffinger, D. J. (1973). Development of new criteria for the evaluation of creative studies programs.
- Parrus, S. J., & Treffinger, D. J. (1973). *Development of new criteria for the evaluation of Creative Studies Programs*. Buffalo: State University of New York, Buffalo College. (ERIC Document Reproduction Service No. ED 346082)
- \*Reiter-Palmon, R., Mumford, M.D., Boes, J. O'C., & Runco, M. A. (1997). Problem construction and creativity: the role of ability, cue consistency, and active processing. *Creativity Research Journal*, 10(1), 9-23.
- \*Richards, R. L. (1976). A comparison of selected Guilford and Wallach-Kogan creative thinking tests in conjunction with measures of intelligence. *The Journal of Creative Behavior*, 10(3), 151-164.
- \*Richardson, A. G. (1988). Classroom learning environment and creativity: some Caribbean findings. *Psychological Reports*, 62, 939-942.
- Rose, L. H. & Lin, H-T. (1984). *A meta-analysis of long-term creativity training programs. Journal of Creativity Behavior*, 18(1), 11-22.
- \*Rostan, S. M. (1994). Problem finding, problem solving, and cognitive controls: an empirical investigation of critically acclaimed productivity. *Creativity Research Journal*, 7(1), 97-110.
- \*Saracho, O. N. (1992). Preschool children's cognitive style and play and implications for creativity. *Creativity Research Journal*, 5(1), 35-47.
- \*Sawyers, J. K., Moran III, J. D., Fu, V. R., & Horn-Wingerd, D. M. (1992). Correlates of metaphoric comprehension in young children. *Creativity*

- Research Journal*, 5(1), 27-33.
- Scope, E. E. (1998). *Meta-analysis of research on creativity: The effects of instructional variables*. Unpublished doctoral dissertation, Fordham University, New York.
- \*Sheldon, K. M. (1995). Creativity and self-determination in personality. *Creativity Research Journal*, 8(1), 25-36.
- Swanson, H. L. & Hoskyn, M. (1998). Experimental intervention research on students with learning disabilities: A meta-analysis of treatment outcomes. *Review of Educational Research*, 68(3), 277-321.
- Torrance, E. P. (1972). Can we teach children to think creatively? *The Journal of Creative Behavior*, 6(2), 114-143.
- \*Wade, S. (1968). Differences between intelligence and creativity: some speculation on the role of environment. *The Journal of Creative Behavior*, 2(2), 97-101.
- \*Ward, W. C. (1975). Convergent and divergent measurement of creativity in children. *Educational and Psychological Measurement*, 35, 87-95.
- 
- \*Albert, A. & Kormos, J. (2004). Creativity and narrative task performance: An exploratory study. *Language Learning*, 54(2), 277-310.
- \*Alexander P. A., Jetton, T. L., White, S. H., Parsons, J. L., Cotropia, K. K., Liu, H. C., & Ackerman, C. M. (1994). Young children's creative solutions to realistic and fanciful story problems. *The Journal of Creative Behavior*, 28(2), 89-106.
- \*Amrlang, M., Herboth, G. & Oefner, I. (1991). A prototype strategy for the construction of creativity scale. *European Journal of Personality*, 5, 261-285.
- \*Averill, J. R. (1999). Individual differences in emotional creativity: Structure and correlates. *Journal of Personality*, 67(2), 331-371.
- \*Baer, J. (1998). Gender differences in the effects of extrinsic motivation on creativity. *Journal of Creative Behavior*, 32(1), 18-31.
- \* Baer, J. (2003). The impact of the core knowledge curriculum on creativity. *Creativity Research Journal*, 15 (2&3), 297-300.
- \*Basadur, M. (1995). Optimal ideation-evaluation ratios. *Creativity Research Journal*, 8(1), 63-75.
- \*Baughman, W. A. & Mumford, M. D. (1995). Process-analytic models of creative capacities: operations influencing the combination-and-reorganization process. *Creativity Research Journal*, 8(1),

37-62.

- \*Blumen-Pardo, S. (2002). Effects of a teacher training workshop on creativity, cognition, and school achievement in gifted and non-gifted second-grade students in Lima, Peru. *High Ability Studies*, 13(1), 47-58.
- Bullough, V., Bullough, B., & Mauro, M. (1981). History and creativity: research problems and some possible solutions. *The Journal of Creative Behavior*, 15(2), 102-134.
- Bennett, G. K., Doppelt, J. E., & Madans, A. B. (1969). Creativity ratings. *The Journal of Creative Behavior*, 3(1), 41-57.
- \*Brophy, D. R. (2000-2001). Comparing the attributes, activities, and performance of divergent, convergent, and combination thinkers. *Creativity Research Journal*, 13(3&4), 439-455.
- \*Campos, A., Lopez, A., Gonzalez, M. A., & Perez-Fabello, M. J. (2000). Aspects of creativity affected by imaging capacity. *North American Journal of Psychology*, 2(2), 313-323.
- Carlsson, I. (2002). Anxiety and flexibility of defense related to high or low creativity. *Creativity Research Journal*, 14(3&4), 341-349.
- \*Carlozzi, A. F., Bull, K. S., Eells, G. T., & Hurlburt, J. D. (1995). Empathy as related to creativity, dogmatism, and expressiveness. *The Journal of Psychology*, 129(4), 365-373.
- Carpossela, A. K. S. (1999). *Field creativity: reliability of nine criteria for evaluating student projects*. Unpublished doctoral dissertation, The Claremont Graduate University, California.
- Carson, D. K., Becker, K. W., Vance, K. E., & Forth, N. L. (2003). The role of creativity in marriage and family therapy practice: a national online study. *Contemporary Family Therapy*, 25(1), 89-110.
- \*Carson, D. K., Bittner, M. T., Cameron, B. R., Brown, D. M., & Meyer, S. S., (1994). Creative thinking as a predictor of school-aged children's stress responses and coping abilities. *Creativity Research Journal*, 7(2), 145-158.
- Cartwright, M., Clark-Carter, D., Ellis, S. J., & Matthews, C. (2004). Temporal lobe epilepsy and creativity: a model of association. *Creativity Research Journal*, 16(1), 27-34.
- Chan, D. W. (2005). Self-perceived creativity, family hardiness, and emotional intelligence of Chinese gifted students in Hong Kong. *The Journal of Secondary Gifted Education*, 16(2/3), 47-56.
- \*Charles, R. E. & Runco, M. A. (2000-2001). Developmental trends in the evaluative and divergent thinking of children. *Creativity Research Journal*, 13(3&4), 417-437.

- \*Cheung, P. C., Lau, S., Chan, D. W., & Wu, W. Y. H. (2004). Creative potential of school children in Hong Kong: norms of the Wallach-Kogan creativity tests and their implications. *Creativity Research Journal*, 16(1), 69-78.
- \*Christiaans, H. H. C. M. (2002). Creativity as a design criterion. *Creativity Research Journal*, 14(1), 41-54.
- Chung, N. & Ro, G. (2004). The effect of problem-solving in instruction on children's creativity and self-efficacy in the teaching of the practical arts subject. *The Journal of Technology Studies*, 30(2), 116-122.
- \*Clark, K. & James, K. (1999). Justice and positive and negative creativity. *Creativity Research Journal*, 12(4), 311-320.
- Cohen, P. A. (1977). *Statistical power analysis for the behavioral sciences* (2nd ed.). New York: Academic Press.
- Cohen, P. A. (1988). *Statistical power analysis for the behavioral sciences*. Mahwah, NJ: Erlbaum.
- \*Conti, R., Coon, H., & Amabile, T. M. (1996). Evidence to support the componential model of creativity: secondary analyses of three studies. *Creativity Research Journal*, 9(4), 385-389.
- Costa, P. T. Jr., & McCrae, R. R. (1985). *The NEO Personality Inventory manual*. Odessa, FL: Psychological Assessment Resources.
- \*Couturier, L. C., Mansfield, R. S., & Gallagher, J. M. (1981). Relationships between humor, formal operational ability, and creativity in eighth graders. *The Journal of Genetic Psychology*, 139, 221-226.
- \*Cox, A. J. & Leon, J. L. (1999). Negative schizotypal traits in the relation of creativity to psychopathology. *Creativity Research Journal*, 12(1), 25-36.
- Cropley, A. J. (2000). Defining and measuring creativity: are creativity tests worth using? *Roeper Review*, 23(2), 72-79.
- Cropley, D. H. & Cropley, A. J. (2000). Fostering creativity in engineering undergraduates. *High Ability Studies*, 11(2), 207-219.
- \*Daugherty, M., Logan, J., Turner, M., & Compton, D. (2003). Associations among preservice teachers' psychological traits and classroom performance ratings. *The Teacher Educator*, 38(3), 151-168.
- \*Dauw, D. C. (1968). Creativity research on actuaries. *The Journal of Creative Behavior*, 2(4), 274-280.
- \*Davis, G. A. & Belcher, T. (1971). How shall creativity be measured? Torrance tests, RAT, alpha biographical, and IQ. *The Journal of Creative Behavior*, 5(3), 153-161.
- \*Dellas, M. (1971, February). *Effects of creativity training, defensiveness, and intelligence on divergent thinking*. Paper presented at the American

Educational Research Association Convention, New York, NY.

- \*Diakidoy, I. N. & Constantinou, C. P. (2000-2001). Creativity in physics: response fluency and task specificity. *Creativity Research Journal*, 13(3&4), 401-410.
- Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. *Annual Review of Psychology*, 41, 417-440.
- \*Doherty, W. J. & Corsini, D. A. (1976). Creativity, intelligence, and moral development in college women. *The Journal of creative behavior*, 10(4), 276-284.
- Dollinger, S. J., Robinson, N. M., & Ross, V. J. (1999). Photographic individuality, breadth of perspective, and creativity. *Journal of Personality*, 67(4), 624-644.
- \*Dollinger, S. J., Urban, K. K., & James, T. A. (2004). Creativity and openness: further validation of two creative product measures. *Creativity Research Journal*, 16(1), 35-47.
- \*Domino, G. (1994). Assessment of creativity with the ACL: an empirical comparison of four scales. *Creativity Research Journal*, 7(1), 21-33.
- \*Domino, G. & Giuliani, I. (1997). Creativity in three samples of photographers; a validation of the adjective check list creativity scale. *Creativity Research Journal*, 10(2&3), 193-200.
- Domino, G., Schmuck, J., & Schneider, M. (2002). An empirical assessment of the GAM theory of creativity. *Creativity Research Journal*, 14(3&4), 331-339.
- \*Domino, G., Short, J., Evans, A., & Romano, P. (2002). Creativity and ego defense mechanisms: some exploratory empirical evidence. *Creativity Research Journal*, 14(1), 17-25.
- Dow, G. T. & Mayer, R. E. (2004). Teaching students to solve insight problems; evidence for domain specificity in creativity training. *Creativity Research Journal*, 16(4), 389-402.
- Dudek, S. Z. & Hall, W. B. (1984). Some test correlates of high level creativity in architects. *Journal of Personality Assessment*, 48(4), 351-359.
- Engle, D. E., Mah, J. J., & Sadri, G. (1997). An empirical comparison of entrepreneurs and employees: implications for innovation. *Creativity Research Journal*, 10(1), 45-49.
- Eysenck, H. J. & Furnham, A. (1993). Personality and Barron-Welch Art Scale. *Perceptual and Motor Skills*, 76, 837-838.
- Faure, C. (2004). Beyond brainstorming: effects of different group procedures on selection of ideas and satisfaction with the process. *Journal of Creative*

*Behavior*, 38, 13-14.

- \*Feist, G. J. (1997). Quantity, quality, and depth of research as influences on scientific eminence: is quantity most important? *Creativity Research Journal*, 10(4), 325-335.
- Feldhusen, J. F. & Goh, B. E. (1995). Assessing and accessing creativity: an integrative review of theory, research, and development. *Creativity Research Journal*, 8(3), 231-247.
- \*Finton, M. J. (1995). *An application of computational theory to the prediction of creativity in college students*. Unpublished doctoral dissertation, Michigan State University, Michigan.
- Fu, V. R., Canaday, Helen., & Fu, D. T. (1982). Creativity and leadership in preschoolers. *The Journal of Genetic Psychology*, 141, 291-292.
- \*Gaynor, J. L. R. & Runco, M. A. (1992). Family size, birth-order, age-interval, and the creativity of children. *The Journal of Creative Behavior*, 26(2), 108-118.
- \*Gerrard, L. E., Poteat, M., & Ironsmith, M. (1996). Promoting children's creativity: effects of competition, self-esteem and immunization. *Creativity Research Journal*, 9(4), 339-346.
- Glück, J., Ernst, R., & Unger, F. (2002). How creatives define creativity: definitions reflect different types of creativity. *Creativity Research Journal*, 14(1), 55-67.
- Goldsmith, R. E. & Matherly, T. A. (1988). Creativity and self-esteem: a multiple operationalization validity study. *The Journal of Psychology*, 122(1), 47-56.
- Goswami, A. (1996). Creativity and the quantum: a unified theory of creativity. *Creativity Research Journal*, 9(1), 47-61.
- Götz, K. O. & Götz, K. (1979). Personality characteristics of successful artists. *Perceptual and Motor Skills*, 49, 919-924.
- Gough, H. G. (1975). A new scientific uses test and its relationship to creativity in research. *The Journal of Creative Behavior*, 9(4), 245-252.
- Grant, A. M., Langer, E. J., Falk, E., & Capodilupo, C. (2004). Mindful creativity: drawing to draw distinctions. *Creativity Research Journal*, 16(2&3), 261-265.
- Griffin, Murray & McDermott, M. (1998). Exploring a tripartite relationship between rebelliousness, openness to experience and creativity. *Social Behavior and Personality*, 26(4), 347-356.
- \*Guncer, B. & Oral, G. (1993). Relationship between creativity and nonconformity to school discipline as perceived by teachers of Turkish elementary school children, by controlling for their grade and sex. *Journal*

*of Instructional Psychology*, 20(3), 208-214.

- \*Gustafson, R. (1991). Effect of alcohol on quantity of creative production using the Purdue tests. *Psychological Reports*, 69, 83-90.
- \*Gustafson, R. & Norlander, T. (1995). Effects of creative and non-creative work on the tendency to drink alcohol during the restitution phase of the creative process. *Journal of Creative Behavior*, 29(1), 25-35.
- Guastello, S. J., Shissler, J., Driscoll, J., & Hyde, T. (1998). Are some cognitive styles more creatively productive than others? *Journal of Creative Behavior*, 32(2), 77-91.
- \*Han, K. (2000). *Varieties of creativity: investigating the domain-specificity of creativity in young children*. Unpublished doctoral dissertation, University of Nebraska, NE.
- \*Haylock, D. W. (1987). Mathematical creativity in school children. *The Journal of Creativity Behavior*, 21(1), 48-59.
- Hennessey, B. A. (1994). The consensual assessment technique: an examination of the relationship between ratings of product and process creativity. *Creativity Research Journal*, 7(2), 193-208.
- \*Hennessey, B. A. & Zbikowski, S. M. (1993). Immunizing children against the negative effects of reward: a further examination of intrinsic motivation training techniques. *Creativity Research Journal*, 6(3), 297-307.
- Hickey, M. (2001). An application of Amabile's consensual assessment technique for rating the creativity of children's musical compositions. *Journal of Research in Music Education*, 49(3), 234-244.
- Hill, O. W. & Clark, J. L. (1998). Childhood fantasy, creativity, and an internal epistemic style. *Journal of Social Behavior and Personality*, 13(1), 177-183.
- Hinton, B. L. (1970). Personality variables and creative potential. *The Journal of Creative Behavior*, 4(3), 210-217.
- Holland, J. L. & Baird, L. L. (1968). The preconscious activity scale: the development and validation of an originality measure. *The Journal of Creative Behavior*, 2(3), 217-225.
- Houtz, J. C., Selby, E., Esquivel, G. B., Okoye, R. A., Peters, K. M., & Treffinger, D. J. (2003). Creativity styles and personal type. *Creativity Research Journal*, 15(4), 321-330.
- \*Howard-Jones, P. A., Taylor, J. R., & Sutton, L. (2002). The effect of play on the creativity of young children during subsequent activity. *Early Child Development and Care*, 172(4), 323-328.
- \*Howieson, N. (1981). A longitudinal study of creativity—1965-75. *Journal of Creative Behavior*, 15(5), 117-134.

- \*Hu, W. & Adey, P. (2002). A scientific creativity test for secondary school students. *International Journal of Science Education*, 24(4), 389-403.
- Isaksen, S. G. & Lauer, K. J. (2001). Convergent validity of the situational outlook questionnaire; discriminating levels of perceived support for creativity. *North American Journal of Psychology*, 3(1), 31-40.
- Isaksen, S. G., Lauer, K. J., Ekvall, G., & Britz, A. (2000-2001). Perceptions of the best and worst climates for creativity; preliminary validation evidence for the situational outlook questionnaire. *Creativity Research Journal*, 13(2), 171-184.
- \*Jackson, L. M. & Gorassini, D. R. (1989). Artifact in the hypnosis-creativity relationship. *Journal of General Psychology*, 116(4), 333-344.
- \*James, K. & Asums, C. (2000-2001). Personality, cognitive skills, and creativity in different life domains. *Creativity Research Journal*, 13(2), 149-159.
- Jaušovec, N. (1997). Differences in EEF activity during the solution of closed and open problems. *Creativity Research Journal*, 10(4), 317-324.
- Jaušovec, N. & Bakracevic, K. (1995). What can heart rate tell us about the creative process? *Creativity Research Journal*, 8(1), 11-24.
- \*Jönsson, P. & Carlsson, I. (2000). Androgyny and creativity: a study of the relationship between a balanced sex-role and creative functioning. *Scandinavian Journal of Psychology*, 41, 269-274.
- \*Jung, D. I. (2000-2001). Transformational and transactional leadership and their effects on creativity in groups. *Creativity Research Journal*, 13(2), 185-195.
- Kasof, J. (1995). Explaining creativity: the attributional perspective. *Creativity Research Journal*, 8(4), 311-366.
- \*Kasof, J. (1997). Creativity and breadth of attention. *Creativity Research Journal*, 10(4), 303-315.
- Kaufman, J., Gentile, C. A., & Baer, J. (2005). Do gifted student writers and creative writing experts rate creativity the same way? *The Gifted Child Quarterly*, 49(3), 260-266.
- Kelly, K. E. (2004). A brief measure of creativity among college students. *College Student Journal*, 38(4), 594-596.
- Kemple, K. M., David, G. M., & Wang, Y. (1996). Preschoolers' creativity, shyness, and self-esteem. *Creativity Research Journal*, 9(4), 317-326.
- Kerr, B., Shaffer, J., Chambers C., Hallowell, K. (1991). Substance use of creatively talented adults. *Substance Use of Creatively Talented Adults*, 25(2), 145-153.

- \*Kershner, J. R. & Ledger, G. (1985). Effect of sex, intelligence, and style of thinking on creativity: a comparison of gifted and average IQ children. *Journal of Personality and Social Psychology*, 48(4), 1033-1040.
- Khandwalla, P. N. (1993). An exploratory investigation of divergent thinking through protocol analysis. *Creativity Research Journal*, 6(3), 241-259.
- \*Khaleefa, O. H., Erodos, G., & Ashria, I. H. (1996). Gender and creativity in an Afro-Arab Islamic culture: the case of Sudan. *Journal of Creative Behavior*, 30(1), 52-60.
- \*Khatena, J. & Dickerson, E. C. (1973). Training sixth grade children to think creativity with words. *Psychological Reports*, 32, 841-842.
- \*Kiehn, M. (2003). Development of music creativity among elementary school students. *Journal of Research in Music Education*, 151(4), 278-288.
- \*Kline, P. & Cooper, C. (1986). Psychoticism and creativity. *Journal of Genetic Psychology*, 147(2), 183-188.
- \*Koestner, R., Ryan, R. M., Bernieri, F., & Holt, K. (1984). Setting limits on children's behavior; the differential effects of controlling vs. informational styles on intrinsic motivation and creativity. *Journal of Personality*, 52(3), 233-248.
- \*Kogan, N. & Pankove, E. (1974). Long-term predictive validity of divergent-thinking tests: some negative evidence. *Journal of Educational Psychology*, 66(6), 802-810.
- Kolb, J. A. (1992). Leadership of creative teams. *The Journal of Creative Behavior*, 26(1), 1-9.
- \*Krampen, G. (1997). Promotion of creativity (divergent productions) and convergent productions by systematic-relaxation exercises: empirical evidence from five experimental studies with children, young adults, and elderly. *European Journal of Personality*, 11, 83-99.
- \*Kuo, Y. (1967). Creative thinking: delinquent vs. nondelinquent boys. *The Journal of Creative Behavior*, 1(4), 411-418.
- \*Kurtzberg, T. R. (1998). Creative thinking, cognitive aptitude, and integrative joint gain: a study of negotiator creativity. *Creativity Research Journal*, 11(4), 283-293.
- Laius, A & Rannikmäe, M. (2004). The influence of STL teaching and science teachers' teamwork on change of students' creativity. *Journal of Baltic Science Education*, 2(6), 69-75.
- \*Larey, T. S. & Paulus, P. B. (1999). Group preference and convergent tendencies in small groups; a content analysis of group brainstorming performance. *Creativity Research Journal*, 12(3), 175-184.

- Lau, S., Li, C. S., & Chu, D. (2004). Perceived creativity; its relationship to social status and self-concept among Chinese high ability children. *Creativity Research Journal*, 16(1), 59-67.
- \*Lopez, E. C., Esquivel, G. B., & Houtz, J. C. (1993). The creative skills of culturally and linguistically diverse gifted students. *Creativity Research Journal*, 6(4), 401-412.
- Lynch, P. M. (1970). Creativity in Irish children. *The Journal of Creative Behavior*, 4(1), 53-61.
- Ma, H-H. (in press). A synthetic analysis of the effectiveness of single components and packages in creativity training programs. *Creativity Research Journal*.
- \*Martinsen, Ø. (1993). Insight problems revisited: the influence of cognitive styles and experience on creative problem solving. *Creativity Research Journal*, 6(4), 435-447.
- Mathisen, G. E., Einarsen, S., Jørstad, K., & Brønnick, K. S. (2004). Climate for work group creativity and innovation: Norwegian validation of the team climate inventory. *Scandinavian Journal of Psychology*, 45, 383-392.
- \*McCormack, A. J. (1975). Nonverbal administration protocols for figural tasks of the Torrance Tests of creative thinking. *The Journal of Creative Behavior*, 9(2), 88-96.
- \*McCoy, J. M. & Evans, G. W. (2002). The potential role of the physical environment in fostering creativity. *Creativity Research Journal*, 14(3&4), 409-426.
- \*Mednick, M. T. & Andrew, F. M. (1967). Creative thinking and level of intelligence. *The Journal of Creative Behavior*, 1(4), 428-431.
- \*Metcalfe, R. J. A. (1978). Divergent thinking "Threshold Effect"—IQ, age, or skill? *Journal of Experimental Education*, 47(1), 4-8.
- \*Miga, E., Burger, K., Hetland, L., & Winner, E. (1998). Does studying the arts engender creative thinking? evidence for near but not far transfer. *Journal of Aesthetic Education*, 34(3/4), 91-105.
- \*Moblely, M. I., Doares, L. M., & Mumford, M. D. (1992). Process analytic models of creative capacities; evidence for the combination and reorganization process. *Creativity Research Journal*, 5(2), 125-155.
- \*Moneta, G. B. (2002). Trait intrinsic and extrinsic motivations, academic performance, and creativity in Hong Kong college students. *Journal of College Student Development*, 43(5), 664-683.
- Morgan, M. L. & Wampler, K. S. (2003). Fostering client creativity in family therapy: a process research study. *Contemporary Family Therapy*, 25(2),

207-228.

- Morse, D. T. & Khatena, J. (1989). The relationship of creativity and life accomplishments. *The Journal of Creative Behavior*, 23(1), 59-65.
- \*Mouchiroud, C. & Lubart, T. (2002). Social creativity: a cross-sectional study of 6-to 11-year-old children. *International Journal of Behavioral Development*, 26(1), 60-69.
- \*Mumford, M. D., Baughman, W. A., Maher, M. A., Costanza, D. P., & Supinski, E. P. (1997). Process-based measures of creative problem-solving skills: IV. category combination. *Creativity Research Journal*, 10(1), 59-71.
- \*Mumford, M. D., Baughman, W. A., Supinski, E. P., & Maher, M. A. (1996). Process-based measures of creative problem-solving skills; II. information encoding. *Creativity Research Journal*, 9(1), 77-88.
- \*Mumford, M. D., Baughman, W. A., Threlfall, K. V., Supinski, E. P., & Costanza, D. P. (1996). Process-based measures of creative problem-solving skills: I. problem construction. *Creativity Research Journal*, 9(1), 63-76.
- Mumford, M. D. & Gustafson, S. B. (1988). Creativity syndrome: integration, application, and innovation. *Psychological Bulletin*, 103(1), 27-43.
- \*Mumford, M. D., Supinski, E. P., Baughman, W. A., Costanza, D. P., & Threlfall, K. V. (1997). Process-based measures of creative problem-solving skills: V. overall prediction. *Creativity Research Journal*, 10(1), 73-85.
- \*Mumford, M. D., Supinski, E. P., Threlfall, K. V., & Baughman, W. A. (1996). Process-based measures of creative problem-solving skills: III. category selection. *Creativity Research Journal*, 9(4), 395-406.
- Niaz, M. & Nunez, G. S. D. (1991). The relationship of mobility-fixity to creativity formal reasoning and intelligence. *The Journal of Creative Behavior*, 25(3), 205-217.
- \*Niu, W. & Sternberg, R. J. (2001). Cultural influences on artistic creativity and its evaluation. *Journal of Psychology*, 36(4), 225-241.
- \*Norlander, T., Erixon, A., & Archer, T. (2000). Psychological androgyny and creativity: dynamics of gender-role and personality trait. *Social Behavior and Personality*, 28(5), 423-436.
- Norlander, T. & Gustafson, R. (1996). Effects of alcohol on scientific thought during the incubation phase of the creative process. *Journal of Creative Behavior*, 30(4), 231-248.
- \*Ononye, G. C., Blinn-Pike, L. M., & Smith, D. E. (1993). Creativity and future time perspective: exploring fantasy and realistic measures. *Creativity Research Journal*, 6(4), 449-456.

- Palaniappan, A. K. (1998). Figural creativity and cognitive preference among Malaysian undergraduate students. *The Journal of Psychology, 132*(4), 381-388.
- \*Parnes, S. J. & Treffinger, D. J. (1973). *Development of new criteria for the evaluation of creative studies programs*. NY: State University of New York, Albany, Research Foundation; NY: State University of New York, Buffalo, College at Buffalo. (ERIC Document Reproduction Service No. ED082142)
- Pavlik, L. (2000). *Structured imagination and the writing of creative stories*. Unpublished doctoral dissertation, University of Fordham, NY.
- \*Pearlman, C. (1983). Teachers as an informational resource in identifying and rating student creativity. *Education, 103*(3), 215-222.
- \*Pickard, E. (1990). Toward a theory of creative potential. *The Journal of Creative Behavior, 24*,1-9.
- Plucker, J. A. (1999). Is the proof in the pudding? reanalysis of Torrance's (1958 to present) longitudinal data. *Creativity Research Journal, 12*, 103-114.
- Plucker, J. A. (2004). Generalization of creativity across domains: examination of the method effect hypothesis. *Journal of Creative Behavior, 38*(1), 1-11.
- Pollick, M. F. & Kumar, V. K. (1997). Creativity styles of supervising managers. *Journal of Creativity Behavior, 31*(4), 260-270.
- Proctor, R. M. J. & Burnett, P. C. (2004). Measuring cognitive and dispositional characteristics of creativity in elementary students. *Creativity Research Journal, 16*(4), 421-429.
- Puccio, G. J., Treffinger, D. J., & Talbot, R. J. (1995). Exploratory examination of relationships between creativity styles and creative products. *Creativity Research Journal, 8*(2), 157-172.
- \*Raina, M. K. (1969). A study of sex differences in creativity in India. *The Journal of Creative Behavior, 3*(2), 111-114.
- \*Reiter-Palmon, R., Mumford, M. D., Boes, J. O., & Runco, M. A. (1997). Problem construction and creativity: the role of ability, cue consistency, and active processing. *Creativity Research Journal, 10*(1), 9-23.
- \*Reuter, M., Panksepp, J., Schnabel, N., Kellerhoff, N., Kempel, P., & Hennig, J. (2005). Personality and biological markers of creativity. *European Journal of Personality, 19*, 83-95.
- \*Richards, R. L. (1976). A comparison of selected Guilford and Wallach-Kogan Creative Thinking Tests in conjunction with measures of intelligence. *The Journal of Creative Behavior, 10*(3), 151-164.

- \*Richardson, A. G. (1988). Classroom learning environment and creativity: some Caribbean findings. *Psychological Reports*, 62, 939-942.
- Rhodes, M. (1961). An analysis of creativity. *Phi Delta Kappan*, 42, 305-310.
- Rosenthal, R. & DiMatteo, M. R. (2001). Meta-analysis: recent developments in quantitative methods for literature reviews. *Annual Review of Psychology*, 52, 59-82.
- \*Rostan, S. M. (1994). Problem finding, problem solving, and cognitive controls: an empirical investigation of critically acclaimed productivity. *Creativity Research Journal*, 7(2), 97-110.
- \*Rostan, S. M. (1997). A study of Young artists: the development of artistic talent and creativity. *Creativity Research Journal*, 10(2&3), 175-192.
- \*Rostan, S. M., Pariser, D., & Gruber, H. E. (2002). A cross-cultural study of the development of artistic talent, creativity and giftedness. *High Ability Studies*, 13(2), 125-155.
- \*Rudowicz, e., Lok, D., & Kitto, J. (1995). Use of the Torrance tests of creative thinking in an exploratory study of creativity in Hong Kong primary school children: a cross-cultural comparison. *International Journal of Psychology*, 30(4), 417-430.
- \*Ruokonen, I. & Vikat, M. (2005). The creativity of gifted children in Estonia and Finland from a musical and environmental perspective. *Trames: A Journal of the Humanities & Social Sciences*, 9(1), 49-68.
- \*Runco, M. A. (1984). Teachers' judgments of creativity and social validation of divergent thinking tests. *Perceptual and Motor Skills*, 59, 711-717.
- \*Runco, M. A. (1986). Flexibility and originality in children's divergent thinking. *The Journal of Psychology*, 120(4), 345-352.
- \*Runco, M. A. (1987). Birth-order and divergent thinking. *Journal of Genetic Psychology*, 148(1), 119-125.
- Runco, M. A. & Johnson, D. J. (1993). Parents' and teachers' implicit theories of children's creativity. *Child Study Journal*, 23(2), 91-113.
- Runco, M. A. & Johnson, D. J. (2002). Parents' and Teachers' implicit theories of children's creativity: a cross-cultural perspective. *Creativity Research Journal*, 14(3), 427-438.
- Runco, M. A., Nemiro, J., & Walberg, H. J. (1998). Personal explicit theories of creativity. *Journal of Creative Behavior*, 32(1), 1-17.
- \*Runco, M. A. & Okuda, S. M. (1991). The instructional enhancement of the flexibility and originality scores of divergent thinking tests. *Applied Cognitive Psychology*, 5, 435-441.
- \*Ruscio, A. M. & Amabile, T. M. (1999). Effects of instructional style on

- problem-solving creativity. *Creativity Research Journal*, 12(4), 251-266.
- \*Ruscio, J., Whitney, D. M., & Amabile, T. M. (1998). Looking inside the fishbowl of creativity: verbal and behavioral predictors of creative performance. *Creativity Research Journal*, 11(3), 243-263.
- \*Russ, S. W., Robins, A. L., & Christiano, B. A. (1999). Pretend play: longitudinal prediction of creativity and affect in fantasy in children. *Creativity Research Journal*, 12(2), 129-139.
- \*Russ, C. F. (2004). A comparative study of creativity and cognitive problem-solving strategies of high-IQ and average students. *The Gifted Child Quarterly*, 48(3), 179-190.
- \*Saracho, O. N. (1992). Preschool children's cognitive style and play and implications for creativity. *Creativity Research Journal*, 5(1), 35-47.
- \*Sawyers, J. K., Moran III, J. D., Fu, V. R., & Horm-Wingerd, D. M. (1992). Correlates of metaphoric comprehension in young children. *Creativity Research Journal*, 5(1), 27-33.
- Schuldberg, D. (2000-2001). Six subclinical spectrum traits in normal creativity. *Creativity Research Journal*, 13(1), 5-16.
- Seitz, J. A. (1997). The development of metaphoric understanding: implications for a theory of creativity. *Creativity Research Journal*, 10(4), 347-353.
- \*Shalley, C. E. & Oldham, G. R. (1997). Competition and creative performance: effects of competitor presence and visibility. *Creativity Research Journal*, 10(4), 337-345.
- Simonton, D. K. (2004). Film awards as indicators of cinematic creativity and achievement; a quantitative comparison of the Oscars and six alternatives. *Creativity Research Journal*, 16(2&3), 163-172.
- \*Sosik, J. J., Kahai, S. S., & Avolio, B. J. (1998). Transformational leadership and dimensions of creativity: motivating idea generation in computer-mediated groups. *Creativity Research Journal*, 11(2), 111-121.
- Fleith, D. D. S., Renzulli, J. S., & Westberg, K. L. (2002). Effects of a creativity training program on divergent thinking abilities and self-concept in monolingual and bilingual classrooms. *Creativity Research Journal*, 14(3&4), 373-386.
- Stasinos, D. P. (1984). Enhancing the creative potential and self-esteem of mentally handicapped Greek children. *The Journal of Creative Behavior*, 18(2), 117-132.
- Sternberg, R. J. and Lubart, T. I. (1995). *Defying the crowd: Cultivating creativity in a culture of conformity*. New York: Free Press.

- Stokos, D., Clitheroe, C., & Zmuidzinas, M. (2002). Qualities of work environments that promote perceived support for creativity. *Creativity Research Journal*, 14(2), 137-147.
- \*Torrance, E. P. (1970). Achieving socialization without sacrificing creativity. *The Journal of Creative Behavior*, 4(3), 183-189.
- \*Torrance, E. P. (1972). Predictive validity of the Torrance Tests of creative thinking. *The Journal of Creative Behavior*, 6(4), 236-252.
- \*Torrance, E. P. & Aliotti, N. C. (1969). Sex differences in levels of performance and test-retest reliability on the Torrance tests of creative thinking ability. *The Journal of Creative Behavior*, 3(1), 52-57.
- \*Thomas, N. G. & Berk, L. E. (1981). Effects of school environments on the development of young children's creativity. *Child Development*, 52(4), 1153-1162.
- Treffinger, D. J., Isaksen, S. G., & Firestien, R. L. (1983). Theoretical perspectives on creative learning and its facilitation: an overview. *The Journal of Creative Behavior*, 17(1), 9-17.
- Treffinger, D. J. & Ripple, R. E. (1969). Developing creative problem solving abilities and related attitudes through programmed instruction. *The Journal of Creative Behavior*, 3(2), 105-110.
- \*Trevlas, E., Matsouka, O., & Zachopoulou, E. (2003). Relationship between playfulness and motor creativity in preschool children. *Early Child Development and Care*, 173(5), 535-543.
- \*Udell, G. G., Baker, K. G., & Albaum, G. S. (1976). Creativity: necessary, but not sufficient. *The Journal of Creative Behavior*, 10(2), 92-103.
- \*Vartanian, O., Martindale, C., & Kwiatkowski, J. (2003). Creativity and inductive reasoning: the relationship between divergent thinking and performance on Wason's 2-4-6 task. *The Quarterly Journal of Experimental Psychology*, 56(4), 641-655.
- \*Wade, S. (1968). Differences between intelligence and creativity: some speculation on the role of environment. *The Journal of Creative Behavior*, 2(2), 97-101.
- Walberg, H. J. & Stariha, W. E. (1992). Productive human capital: learning, creativity, and eminence. *Creativity Research Journal*, 5(4), 323-340.
- Walberg, H. J. & Welch, W. W. (1967). Personality characteristics of innovative physics teachers. *The Journal of Creative Behavior*, 1(2), 163-171.
- \*Wallinga, C. R. & Crase, S. J. (1982). Creativity in husbands and wives. *The Journal of Creative Behavior*, 16(4), 277-283.
- \*Ward, W. C. (1975). Convergent and divergent measurement of creativity in

- children. *Educational and Psychological Measurement*, 35, 87-95.
- \*Weinstein, S. & Graves, R. E. (2001). Creativity, schizotypy, and laterality. *Cognitive Neuropsychiatry*, 6(2), 131-146.
- Westby, E. L. & Dawson, V. L. (1995). Creativity: asset or burden in the classroom? *Creativity Research Journal*, 8(1), 1-10.
- Wolfradt, U. & Pretz, J. (2001). Individual differences in creativity: personality, story writing, and hobbies. *European Journal of Personality*, 15, 297-310.
- \*White, K. (1968). Anxiety, extraversion-introversion, and divergent thinking ability. *The Journal of Creative Behavior*, 2(2), 119-127.
- Wikström, B., Ekvall, G., & Sandström, S. (1994). Stimulating the creativity of elderly institutionalized women through works of art. *Creativity Research Journal*, 7(2), 171-182.
- \*Wolfradt, U. & Pretz, J. E. (2001). Individual differences in creativity: personality, story writing, and hobbies. *European Journal of Personality*, 15, 297-310.
- Wortman, P. M. & Bryant, F. B. (1985). School desegregation and black achievement. *Sociological Methods & Research*, 13(3), 289-324.
- Wycoff, E. B. & Pryor, B. (2003). Cognitive processing, creativity, apprehension, and the humorous personality. *North American Journal of Psychology*, 5(1), 31-45.
- Yeh, Y. (2004). The interactive influences of three ecological systems on R & D employees' technological creativity. *Creativity Research Journal*, 16(1), 11-25.
- Yurtsever, G. (1998). Ethical beliefs and creativity. *Journal of Social Behavior and Personality*, 13(4), 747-754.