

ADAPTION-INNOVATION AND THE TORRANCE TESTS OF CREATIVE THINKING: THE LEVEL-STYLE ISSUE REVISITED¹

SCOTT G. ISAKSEN AND GERARD J. PUCCIO

*Center for Studies in Creativity
State University College at Buffalo*

Summary.—Kirton has asserted that his measure of creative style, Kirton Adaption-Innovation Inventory, is discrete or orthogonal to level measures of creativity. This study used a well-established measure, the Torrance Tests of Creative Thinking, on a relatively larger sample than in previous studies. Scores for 132 (40 men, 92 women) college students on Kirton's measure were significantly correlated with scores on Torrance's Fluency, Flexibility, and Originality subtests. Further, *t* tests showed a significant difference between the extreme adaptor and innovator groups for fluency.

The prevalence of change, competition, and complexity continues to provide support for the pursuit of knowledge within the broad domain known as creativity. The research literature within this field has been reviewed by various writers (Ghiselin, 1952; Hallman, 1981; Isaksen, 1987; Parnes & Harding, 1962; Raina, 1980; Rothenberg & Greenberg, 1976; Stein, 1974, 1975a; Taylor & Getzels, 1975; Treffinger, 1986; Vernon, 1970). Given the diversity of theories and definitions of creativity, there have been various approaches to its study.

Given the inherent difficulties in defining and assessing creative personalities, identifying individuals at the extremes of a distribution provided an expedient way to find agreement over the level of creativity visibly present within those selected for study. In short, highly creative persons were the easiest to identify. This approach, among other developments, provided the foundation for a level orientation toward creativity as illustrated in the identification of the creative personality and the study of "genius."

Early historical focus for research was on the identification of creative talent. This search was primarily carried out by psychologists concerned with identifying individual differences in people. One of the earliest to inquire into the nature of genius was Galton (1869) who attempted to understand the hereditary determination of creative performances. This early focus on genius and eminence provided evidence of the bias of examining high levels of creativity in people and provides the early formation of the "level" approach to understanding creativity. This approach has been reinforced by research on intelligence (Getzels, 1987) and on the study of creative personality characteristics (MacKinnon, 1978). An example of this focus can be

¹Correspond with S. G. Isaksen, State University College at Buffalo, Center for Studies in Creativity, Chase Hall 218, 1300 Elmwood Avenue, Buffalo, NY 14222.

seen in the speech given by Guilford (1950) who indicated that the search for patterns of creative behavior should be focused on people who consistently exhibited this behavior to a "marked degree."

The historical focus has been on how much creativity a person possesses. The primary question was "To what extent is this person creative?" The purpose of the level approach to examining creativity was to assess the effectiveness or quality of creative ability. A more recent line of investigation has inquired into the question: "How are you creative?" The focus of this second question is upon the manner, form, or style of the creative behavior (or performance). Style refers to the preferences or characteristics which denote a consistent manner or way of showing creativity. These two questions provide the level-style distinction within the field of creativity research.

The distinction between level and style may reflect differences in the historical development of the measurement methods for each approach. Abilities are generally considered to be unipolar and are measured in terms of level of performance (Messick, 1976). Ability measures are typically paper-and-pencil tests concerned with correctness, accuracy of response and over-all levels of achievement. By contrast, styles are measured by assessing the manner of performance and so are bipolar dimensions. The measurement of cognitive style is rooted in the study of perception and personality. For this reason, psychologists concerned with the measurement of style have used clinical tools or laboratory apparatus.

Although the concepts of level and style appear to be discrete, in reality the distinctions are not so clear. Messick (1976) has reported that there are variables, such as fluency and flexibility, which are not clearly abilities nor cognitive styles (or, which possess characteristics associated with both abilities and cognitive styles). According to Messick, the "intimate intertwining of abilities and cognitive styles" (p. 11) can be found within the study of creativity.

Kirton (1976) has developed a measure of creative style, the Adaption-Innovation Inventory. Scores place individuals on a continuum indicating their preference for an adaptive or innovative style of problem solving, decision making and creativity. The adaptive style is characterized by working within the given structure of a problem, precision, reliability, and conformity. The innovative style is characterized by approaching tasks from unsuspected angles, not being limited by the boundaries of a problem, and being seen as undisciplined. When generating ideas Kirton (1987b) holds that the adaptor prefers to produce fewer original ideas, focusing on those which are sound and useful. Innovators proliferate original ideas focusing on generating a large quantity of which some are likely to be radical or "paradigm-cracking."

Kirton (1987a) has argued that his inventory clearly separates style from level. This assertion has been the subject of some recent psychological studies. In an early study, Kirton (1978) examined the relationship between the inventory and the Word Fluency measure of the Primary Mental Abilities Battery (Thurstone & Thurstone, 1974), the Utilities and Alternate Uses Tests (French, Ekstrom, & Price, 1963), the Otis (Higher Form A) intelligence test (Otis, 1922) and an English qualifying examination. He found weak and nonsignificant correlations between his measure of style and those measures of level. It is not surprising to find that some measures of intelligence do not correlate with creativity measures as some measures of intelligence have a rather narrow focus on the abilities they assess (Guilford, 1977). In addition, much of the intelligence research does suggest a separation between measures of creativity and intelligence is warranted (Wallach, 1971).

Torrance and yun Horng (1980) also examined the relationship between Kirton's measure and a battery of creative level measures. Significant correlations were reported for Kirton's measure and a number of these level measures, including What Kind of Person Are You (Khatena & Torrance, 1976), Physiognomic Cue Test (Stein, 1975b), Creative Motivation Scale (Torrance, 1971), Creative Self-perception (Something About Myself) (Khatena & Torrance, 1976), an abbreviated battery of the Torrance Tests of Creative Thinking (Torrance, 1974), and most subscales of the Style of Thinking and Learning (Torrance, Reynolds, Ball, & Riegel, 1978).

TABLE 1
RESULTS OF KIRTON'S FACTOR ANALYSIS FOR THE TORRANCE TESTS OF CREATIVITY

Torrance	Presumed Style Factor	Presumed Level Factor
Fluency	< .30	.87
Originality	.35	.84
Flexibility	.33	.69

Kirton acquired the data from the Torrance and yun Horng study and performed a factor analysis. Kirton (1987b) found support for his assertion that two principal factors should emerge from all of the items provided from the measures. Kirton labeled one of these factors "style" as items from his measure and the Right/Left Hemispheric Preference from the Style of Thinking and Learning measure loaded on this factor. The other factor Kirton labeled "level" as items from these ability-oriented measures loaded on this factor. Still other measures examined through this factor analysis showed items which loaded on both factors, for example, the factor loadings for the Torrance Tests of Creative Thinking are shown in Table 1. Finally, Kirton noted that some of the measures used in the Torrance and yun

Horng study did not load on either factor. Kirton concluded that a number of tests could be considered to be pure measures of style while others were pure measures of level. Kirton also proposed two other sorts of measures, those that were contaminated since their items loaded on both factors and those which loaded on neither of the two principal factors.

Two studies, Goldsmith and Matherly (1987) and Goldsmith (1987) replicated and extended Torrance and Yun Horng's study. Goldsmith and Matherly (1987) found a significant positive correlation between scores on Kirton's measure and the Creative Motivation Scale (Torrance, 1971) and the Creativity Scale (Smith & Schaefer, 1969). These two measures were identified as creative level measures. Goldsmith and Matherly (1987) reported that the strongest relationship was found between the originality subscale of Kirton's measure and the creative level measures. Goldsmith (1987) found the total score on Kirton's measure to be significantly correlated with What Kind of Person Are You (Khatena & Torrance, 1976) but uncorrelated with Something About Myself (Khatena & Torrance, 1976). A subsequent factor analysis yielded results similar to those reported by Kirton (1987b). Goldsmith found that Kirton's measure dominated the first factor, and Something About Myself dominated the second factor. Further, scores on What Kind of Person Are You loaded on both factors.

Mulligan and Martin (1980) examined the relations between the Alternative Uses and Utility Tests (French, Ekstrom, & Price, 1963), the Figural Fluency Test (Adcock & Webberly, 1971) and Kirton's measure. Their findings showed that the innovative subjects out performed the adaptor and the mixed-style groups on the aggregate score for these three measures of divergent idea production. Gerhardt and Cashman (1980) found a weak correlation between Kirton's measure and the Remote Associates Test (Mednick, 1959), a convergent measure of creative ability. A recent study by Masten and Caldwell-Colbert (1987) examined the relationship between Kirton's measure and Sounds and Images (Khatena & Torrance, 1973). They found a nonsignificant over-all correlation between the style and level measure, however further investigation yielded a significant negative correlation between the adaptors' scores and the level measure. For additional information regarding the level-style distinction see Kirton (1987b, 1987c), Mudd (1986), and Payne (1987).

Researchers who have previously examined the level-style issue may be criticized for a variety of methodological shortcomings, primarily related to their selection of level measures of creativity. These studies used Kirton's instrument as their measure of style of creativity and various measures of level of creativity which were easy to score and administer. Examples of these expedient measures include Possible Jobs (Gershon & Guilford, 1963), Physiognomic Cue Test (Stein, 1975b), Creative Motivation Scale (Tor-

rance, 1971), Creative Self-perception or Something About Myself (Khatena & Torrance, 1976), Creativity Scale (Smith & Schaefer, 1969), Figural Fluency Tests (French, Ekstrom, & Price, 1963), and the Alternate Uses and Utility Tests (Adcock & Webberly, 1971). In one case when an abbreviated version of Torrance's measures of creativity were used, the subjects were reported to be more than a full standard deviation (mean = 120) from the normal population on Kirton's measure (mean = 95.33) (Torrance & Yun Horng, 1980). In the present reexamination of the level-style question the complete verbal edition of the Torrance Tests of Creative Thinking were used with a larger and more representative sample of subjects.

Although the Torrance tests are not universally accepted as creative level measures, these tests have been widely used for evaluating creativity programs (Torrance & Presbury, 1984) therefore there is an extensive literature regarding reliability and validity (Baird, 1972; Chase, 1985; Thorndike, 1972; Torrance, 1987; Treffinger, 1985). Acceptable levels of reliability and increasingly strong evidence of predictive validity (Torrance, 1987) are reported for the Torrance tests. Since a previous study designed to examine the creative level-style issue used an abbreviated version of Torrance tests on a small select sample of advanced graduate students (Torrance & Yun Horng, 1980), and since other studies with more typical samples used self-report inventories (Goldsmith, 1987), this study used the complete version of the Torrance tests to assess behaviors associated with creative abilities.

In his analytic review of Kirton's measure, Mudd (1986) classified 30 measures into five broad categories. These were level, style, mixed style, mixed style/level, and unclassified measures. Mudd classified these 30 measures based upon explicit references made by the test developers and Kirton's (1987b) factor analysis of the measures used by Torrance and Yun Horng (1980). Applying his criteria Mudd placed the Torrance tests in the unclassified category. This study questions this placement, as Mudd fails to cite the Torrance manuals or other comprehensive reviews of the Torrance tests. In addition, Kirton (1987b) himself used the Torrance tests to identify his second factor as creative level. More specifically, the fluency subtest of the Torrance tests resulted in the highest loading of all loadings on Kirton's level factor. Although Torrance makes no claim to sample the entire universe of creative abilities, he (1974) claimed that the tasks do sample a rather wide range of abilities associated with creative behavior. Since the test developer has asserted that the tests are a measure of ability or level and he is supported by a growing body of literature, and the factor analysis performed by Kirton was on a small and skewed population, it seems reasonable to reexamine the Torrance tests as a level measure of creative behavior.

At present, there does not appear to be enough research to clearly support the bold assertion that creative level and style are orthogonal. In fact,

some research has shown a relationship between Kirton's measure and various measures of creative level (Goldsmith, 1987; Goldsmith & Matherly, 1987; Kirton, 1987b; Torrance & Yun Horng, 1980). More research is necessary to examine (and more clearly understand) the relationship between creative level and style. The purpose of this study was to examine the relationship between Kirton's measure of creative style and Torrance's measures of creative level.

METHOD

Subjects

The sample consisted of 64 male and 121 female undergraduate students enrolled in an Introduction to Creative Studies course at the State University College at Buffalo. All subjects were registered for the course through the standard college procedures, and volunteered to participate in the study. The students ranged in age from 17 to 51, with a median age of 20. In general, the students enrolled in this course were from middle-class families, and they represented a diversity of majors. Creative Studies classes, as all college electives, typically draw a representative sampling of the college population at large.

Instruments

Style of creativity was measured by the Kirton Adaption-Innovation Inventory (Kirton, 1976). This is a 32-item questionnaire which requires respondents to indicate, on a five-point scale, how easy or difficult it would be to represent themselves as a certain type of person. Scoring has been devised so those with an adaptive preference will receive low scores and those with an innovative preference will receive high scores on all three subscales. High scores on the Originality subscale are indicative of the creative loner described by Rogers (1959). Low scores on the Efficiency subscale indicates a preference for precision, thoroughness, and reliability. Low scores on the third subscale, Rule/Group Conformity, signify a person who follows rules and has a respect for authority. Former studies have yielded strong internal reliability estimates (Goldsmith, 1985; Kirton, 1976; Mulligan & Martin, 1980).

Level of creativity was measured by the Torrance Tests of Creative Thinking (Verbal B) (Torrance, 1974). This measure of divergent idea production is made up of three subtests, including fluency, flexibility, and originality. The score for fluency represents the subject's ability to generate ideas with words. Flexibility refers to the subject's ability to produce a variety of kinds of ideas. Finally, originality reflects the subject's ability to generate ideas away from the obvious or common responses. Many studies (Torrance, 1974) have yielded high test-retest reliabilities. In addition, many researchers (Torrance, 1974) have investigated the construct, concurrent and

predictive validity of the tests. Overall, these studies have supported its validity as a creativity level measure.

Procedure

One hundred eighty-four subjects (64 male and 120 female) completed Kirton's measure during the second week of the course in the Spring semester of 1987. In the third week of the course Torrance's measure was offered during several structured, out-of-class, optional meetings. One hundred thirty-three subjects (40 male and 93 female) completed Torrance's measure. A total of 132 subjects (40 men and 92 women) completed both instruments.

RESULTS

The mean scores and standard deviations for both measures are reported in Table 2. The results of Kirton's measure are similar to the

TABLE 2
DESCRIPTIVE STATISTICS

Measure	<i>n</i>	<i>M</i>	<i>SD</i>	Range
Kirton				
Entire Sample	184	100.12	14.23	69—135
Men	64	104.67	13.68	76—149
Women	120	97.69	14.27	69—135
Torrance				
Fluency	133	101.68	30.10	26—181
Flexibility	133	46.66	9.76	16—72
Originality	133	61.12	24.69	9—150

findings reported by Goldsmith (1984) ($M = 100.14$, $SD = 10.70$), Goldsmith (1987) ($M = 100.37$, $SD = 11.88$), and Puccio (1987) ($M = 100.28$, $SD = 14.83$). The mean score for the men was significantly differ-

TABLE 3
PEARSON CORRELATIONS FOR THE KIRTON (KAI) AND TORRANCE MEASURES

	Torrance (<i>N</i> = 132)		
	Fluency	Flexibility	Originality
KAI (Total Score)	.23†	.23†	.19*
Originality	.15*	.18*	.18*
Efficiency	.07	.00	-.05
Rule	.23†	.23†	.20†

* $p < .05$. † $p < .01$.

ent ($t_{182} = -3.20$, $p < .01$) from the mean score for the women. The results for the Torrance measure are similar to the norms reported for college populations. There were no significant differences between men and women

on the subtests of this measure. Torrance's tests were scored independently by two scorers from Scholastic Testing Service. The data were processed as two separate groups and the intercorrelations for the fluency, flexibility, and originality subtests were .99, .93, and .99, respectively.

Pearson product-moment correlations were computed for Kirton's measure, and its subscales, and Torrance's tests. Table 3 presents the correlation matrix for these measures and their subscales. Significant correlations were found between the total score and two of the subscales of Kirton's measure (Originality and Rule/Group Conformity) and each of the subtests of Torrance's measure.

TABLE 4
INTERCORRELATIONS BETWEEN SCALES, SUBSCALES, AND SUBTESTS FOR MALES AND FEMALES

	Torrance's Measures		
	Fluency	Flexibility	Originality
Men (<i>n</i> = 40)			
KAI (Total Score)	.35*	.40†	.37†
Originality	.25	.33*	.30*
Efficiency	.10	.11	.10
Rule	.32*	.35*	.30*
Women (<i>n</i> = 92)			
KAI (Total Score)	.20*	.15	.16
Originality	.12	.13	.16
Efficiency	.07	-.05	-.10
Rule	.21*	.18*	.20*

**p* < .05. †*p* < .01.

Table 4 shows the same analysis separately for men and women. Larger correlations were found between the level and style measures for men. Each correlation coefficient computed for men was larger than that for women.

TABLE 5
MEANS, STANDARD DEVIATIONS, AND *t* RATIOS ON TORRANCE'S MEASURES FOR
EXTREME ADAPTORS AND INNOVATORS

Variables	Adaptors, <i>n</i> = 26		Innovators, <i>n</i> = 18		<i>t</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Fluency	92.92	30.31	112.83	30.39	-2.14	.04
Flexibility	44.62	10.04	49.89	11.75	-1.60	.12
Originality	57.19	28.69	72.06	21.98	-1.85	.07

Since the correlation matrices showed significant associations between measures of style and level, two-tailed *t* tests were used to analyze the differences between adaptors and innovators for fluency, flexibility and originality. The *t* tests were calculated only for subjects who had a strong preference (*n* = 44), one standard deviation from the mean, for either adap-

tion or innovation; see Table 5. A significant difference was found for fluency ($t_{42} = -2.23, p < .05$).

DISCUSSION

The purpose of this study was to reexamine Kirton's claim that his measure of creative style is discrete and orthogonal to measures of creative level. The correlational analyses indicate that there is some association between Kirton's style measure and the widely used Torrance measure of creative level. These findings are consistent with those of Goldsmith and Matherly (1987) and Goldsmith (1987) who found significant positive correlations between Kirton's measure and the Creative Motivation Scale (Torrance, 1971), the Creativity Scale (Smith & Schaefer, 1969), and What Kind of Person Are You (Khatena & Torrance, 1976).

A positive and significant correlation was found between the total score of Kirton's measure and the three Torrance subtests. An examination of the correlations from Kirton's subscales indicated significant and positive associations for two of the three subscales. The Rule/Group Conformity subscale produced the strongest correlations, while the Efficiency subscale yielded weak and nonsignificant correlations. Goldsmith and Matherly (1987) found the Originality subscale produced the strongest correlational coefficients. This difference may reflect the use of different creative level measures in each study.

These differences raise questions about the performance of Kirton's subscales. Given Kirton's position about the orthogonality of level and style, a nonsignificant relationship should be found across the subscales. Different subscales appear to correlate significantly with different creative level measures (Goldsmith, 1987). These findings require further examination, particularly in reference to what the level measures have in common with the subscales of Kirton's measure. For example, both the Torrance and Kirton measures purport to assess the concept of originality. However, each measure is constructed with different definitions of originality. Torrance's tests assess the individual's ability to produce uncommon or infrequent responses, whereas Kirton's measure identifies the subject's preference for generating uncommon responses. These different concepts of originality still appear to be significantly related. This is an alternative explanation of Kirton's (1987b) factor analytic results on the basis of which he called the Torrance test a creative level measure contaminated by the style factor. In addition, further research should examine how task demands effect the relationship between creative level and style.

In examining the sex differences between the measures, men produced larger correlations for the total score and scores on each of the three subscales of Kirton's measure and scores on the fluency, flexibility and originality subtests of Torrance's measure. These findings differ from those

of Goldsmith and Matherly (1987) who found stronger correlations for the women on two creative level measures. These sex differences add to the complexity of the creative level-style issue.

To understand better the complex relationships between level and style, more advanced and complex research designs appear to be necessary. The present study went beyond simple correlational tests to examine the relationship between the Kirton and Torrance measures. As Mudd (1986) suggested, the present study grouped subjects as extreme adaptors (one *SD* below the mean) or as extreme innovators (one *SD* above the mean) and examined the differences between these two groups and the Torrance subtests. A significant difference was found for Torrance's measure of fluency; the extreme innovators were more fluent than the extreme adaptors. These results replicate the earlier findings of Puccio (1987).

Although Kirton (1987a) asserts a clear distinction between his measure of creative style and other measures of creative level, this study points out that the distinction may not be as clear as Kirton asserts, particularly for verbal fluency. For example, Kirton has described the adaptor as preferring to produce fewer ideas, while the innovator will prefer to produce many. Kirton has maintained that there should be no relation between these preferences for idea production and the actual capacity to produce ideas. The *t* tests have shown a significant difference in the number of ideas generated by adaptors and innovators. Whether these differences are the result of the style measure containing a level dimension or the level measure containing a style dimension is open for further inquiry. Research may utilize factor-analytic approaches to understand these relationships. Such studies should utilize the full batteries of the measures with a representative population.

Although some may assert that style and level are opposite, dichotomous or orthogonal constructs, relationships can and should be found depending upon the context, task and persons involved. As Treffinger (1986) has indicated, it may be more productive and useful to examine both style and level to obtain a more comprehensive profile of abilities and preferences.

Research should explore which level-oriented variables would be correlated in the expected direction with various style variables. It seems reasonable that there may be some level-style distinctions which are possible and clear, while others may show relation. These studies need to be complemented by a stronger theoretical framework within which to make these predictions. An improved theoretical framework would provide positive results for those interested in examining style and level of creative behavior.

Although some support for the predictive validity of creative level measures exists, further examination is needed to determine the predictive effectiveness of Kirton's measure. More complex experimental research de-

signs appear to be necessary, and a broad array of creative level measures such as figural, behavioral and motivational indicators of creative performance seem desirable.

In conclusion, although the broad separation between level and style can be supported, it may not (and should not) be as pure as Kirton suggests. In fact, to improve teaching, training and other interventions aimed at problem solving, decision making and creativity, it may be necessary to understand better the relation between creative level and style.

REFERENCES

- ANDCOCK, C. J., & WEBBERLY, M. (1971) Primary mental abilities. *Journal of General Psychology*, 84, 229-243.
- BAIRD, L. L. (1972) Review of the Torrance Tests of Creative Thinking. In O. K. Buros (Ed.), *The seventh mental measurements yearbook*. Vol. 1. Highland Park, NJ: Gryphon Press. Pp. 836-838.
- CHASE, C. C. (1985) Review of the Torrance Tests of Creative Thinking. In J. V. Mitchell (Ed.), *The ninth mental measurements yearbook*. Vol. 2. Lincoln, NE: The Buros Institute of Mental Measurements. Pp. 1631-1632.
- FRENCI, J. W., ECKSTROM, R. B., & PRICE, L. A. (1963) *Manual for Reference Tests of Cognitive Factors*. Princeton, NJ: Educational Testing Services.
- GALTON, F. (1869) *Hereditary genius*. London: Macmillan.
- GERHARDT, J. R., & CASHMAN, J. F. (1980) The measurement and impact of creativity in work groups. *Journal of Creative Behavior*, 14, 216-221.
- GERSHON, A., & GUILFORD, J. P. (1963) *Possible jobs: scoring guide*. Orange, CA: Sheridan Psychological Services.
- GETZELS, J. W. (1987) Creativity, intelligence, and problem finding: retrospect and prospect. In S. G. Isaksen (Ed.), *Frontiers in creativity research: beyond the basics*. Buffalo, NY: Bearly Ltd. Pp. 88-102.
- GISELIN, B. (Ed.) (1952) *The creative process*. Berkeley, CA: Univer. of California Press.
- GOLDSMITH, R. E. (1984) Personality characteristics associated with adaption-innovation. *Journal of Psychology*, 117, 159-165.
- GOLDSMITH, R. E. (1985) Personality and adaptive-innovative problem solving. *Journal of Social Behavior and Personality*, 1, 95-106.
- GOLDSMITH, R. E. (1987) Creative level and creative style. *British Journal of Social Psychology*, 26, 317-323.
- GOLDSMITH, R. E., & MATHERLY, T. A. (1987) Adaption-innovation and creativity: a replication and extension. *British Journal of Social Psychology*, 26, 79-82.
- GUILFORD, J. P. (1950) Creativity. *American Psychologist*, 14, 469-479.
- GUILFORD, J. P. (1977) *Way beyond the IQ*. Buffalo, NY: Creative Education Foundation.
- HALLMAN, R. J. (1981) The necessary and sufficient conditions of creativity. In J. C. Gowan, J. Khatena, & E. P. Torrance (Eds.), *Creativity: its educational implications*. Dubuque, IA: Kendall/Hunt. Pp. 19-30.
- ISAKSEN, S. G. (Ed.) (1987) *Frontiers of creativity research: beyond the basics*. Buffalo, NY: Bearly Ltd.
- KHATENA, J., & TORRANCE, E. P. (1973) *Thinking creatively with sounds and words: norms—technical manual*. (Rev. ed.) Lexington, MA: Personal Press.
- KHATENA, J., & TORRANCE, E. P. (1976) *Manual for Khatena-Torrance Creative Perception Inventory*. Chicago, IL: Stoelting.
- KIRTON, M. J. (1976) Adaptors and innovators: a description and measure. *Journal of Applied Psychology*, 61, 622-629.
- KIRTON, M. J. (1978) Have adaptors and innovators equal levels of creativity? *Psychological Reports*, 42, 695-698.
- KIRTON, M. J. (1987a) Adaptors and innovators: cognitive style and personality. In S. G. Isaksen (Ed.), *Frontiers in creativity research: beyond the basics*. Buffalo, NY: Bearly Ltd. Pp. 282-313.
- KIRTON, M. J. (1987b) *Kirton Adaption-Innovation Inventory manual*. (2nd ed.) Hatfield, UK: Occupational Research Centre.
- KIRTON, M. J. (1987c) M. J. Kirton's reply to R. I. Payne's article "Individual differences and performance of R & D personnel." *R & D Management*, 17, 163-166.

- MACKINNON, D. W. (1978) *In search of human effectiveness: identifying and developing creativity*. Buffalo, NY: Bearly Ltd.
- MASTEN, W. G., & CALDWELL-COLBERT, A. T. (1987) Relationship of originality to Kirton's scale for innovators and adaptors. *Psychological Reports*, 61, 411-416.
- MEDNICK, S. A. (1959) *Remote Associates Test*. New York: Houghton Mifflin.
- MESSICK, S. (Ed.) (1976) *Individuality in learning: implications of cognitive styles and creativity for human development*. San Francisco, CA: Jossey-Bass Publishers.
- MUDD, S. (1986) Analytic review of research on the Kirton Adaption-Innovation Inventory (Kirton's measure). *Social and Behavioral Sciences Documents*, 16, 2. (Ms. No. 2775).
- MULLIGAN, G., & MARTIN, W. (1980) Adaptors, innovators and Kirton Adaption-Innovation Inventory. *Psychological Reports*, 46, 883-892.
- OTIS, A. S. (1922) *Otis self-administering tests of mental ability (higher form A)*. New York: World Book.
- PARNES, S. J., & HARDING, H. F. (Eds.) (1962) *A source book for creative thinking*. New York: Scribners.
- PAYNE, R. (1987) Individual differences & performance amongst R & D personnel: some implications for management development. *R & D Management*, 17, 3, 153-161.
- PUCCIO, G. J. (1987) The effect of cognitive style upon problem-defining behavior. Unpublished Master's thesis, State Univer. College at Buffalo.
- RAINA, M. K. (Ed.) (1980) *Creativity research: international perspective*. New Delhi, India: National Council of Educational Research and Training.
- RIODES, M. (1961) An analysis of creativity. *Phi Delta Kappan*, 42, 305-310.
- ROGERS, C. R. (1959) Towards a theory of creativity. In H. H. Anderson (Ed.), *Creativity and its cultivation*. New York: Harper. Pp. 69-82.
- ROTHENBERG, A., & GREENBERG, B. (1976) *The index of scientific writings in creativity*. Hamden, CT: Shoe String Press.
- SMITH, J. M., & SCHAEFFER, C. E. (1969) Development of a creativity scale for the adjective check list. *Psychological Reports*, 25, 87-92.
- STEIN, M. I. (1974) *Stimulating creativity: individual procedures*. New York: Academic Press.
- STEIN, M. I. (1975a) *Stimulating creativity: group procedures*. New York: Academic Press.
- STEIN, M. I. (1975b) *Manual: Physiognomic Cue Test*. New York: Academic Press.
- TAYLOR, I. A., & GETZELS, J. W. (Eds.) (1975) *Perspectives in creativity*. Chicago, IL: Aldine.
- THORNDIKE, R. L. (1972) Review of the Torrance Tests of Creative Thinking. In O. K. Buros (Ed.), *The seventh mental measurements yearbook*. Vol. 1. Highland Park, NJ: Gryphon Press. Pp. 838-839.
- THURSTONE, L. L., & THURSTONE, G. W. (1947) *Primary Mental Abilities*. Chicago, IL: Science Research Associates.
- TORRANCE, E. P. (1971) *Technical-norms manual for the Creative Motivation Scale*. Athens, GA: Georgia Studies of Creative Behavior, Univer. of Georgia.
- TORRANCE, E. P. (1974) *Torrance Tests of Creative Thinking: norms and technical manual*. Bensenville, IL: Scholastic Testing Services.
- TORRANCE, E. P. (1987) *Survey of the uses of the Torrance Tests of Creative Thinking*. Bensenville, IL: Scholastic Testing Service.
- TORRANCE, E. P., & PRESBURY, J. (1984) The criteria of success used in 242 recent experimental studies of creativity. *The Creative Child and Adult Quarterly*, 5, 80-85.
- TORRANCE, E. P., REYNOLDS, C. R., BALL, O. E., & REIGEL, T. R. (1978) *Revised norms-technical manual for Your Style of Learning and Thinking*. Athens, GA: Georgia Studies of Creative Behavior, Univer. of Georgia.
- TORRANCE, E. P., & YUN HONG, R. (1980) Creativity and style of learning and thinking characteristics of adaptors and innovators. *The Creative Child and Adult Quarterly*, 5, 80-85.
- TREFFINGER, D. J. (1985) Review of the Torrance test of creative thinking. In J. V. Mitchell (Ed.), *The ninth mental measurements yearbook*. Vol. 2. Lincoln, NE: The Buros Institute of Mental Measurements. Pp. 1632-1634.
- TREFFINGER, D. J. (1986) Research on creativity. *Gifted Child Quarterly*, 30, 15-19.
- VERNON, P. E. (Ed.) (1970) *Creativity*. New York: Penguin.
- WALLACE, M. A. (1971) *The intelligence/creativity distinction*. New York: General Learning Press.
- WELSH, S. G. (1973) Perspectives in the study of creativity. *Journal of Creative Behavior*, 7, 231-246.

Accepted September 13, 1988.