

CREATIVITY TRAINING AND THE STABILITY AND INTERNAL CONSISTENCY OF THE KIRTON ADAPTION-INNOVATION INVENTORY¹

MARY C. MURDOCK, SCOTT G. ISAKSEN, AND KENNETH J. LAUER

*Center for Studies in Creativity
Buffalo State College*

Summary.—In his 1986 analytic review of the first ten years of research on adaption-innovation theory, Mudd commented on the importance of continued research on the Kirton Adaption-Innovation Inventory. Suggestions pertinent to the present study involved an examination of the stability of the instrument as well as the test-retest reliability of the full scale and subscales. A Lindquist Type III analysis of variance was used to examine the influence of creativity training on the stability of the Kirton full scale scores. The scores did not change after training. There was, however, a significant effect for gender by pre- and posttest interactions for the full scale scores. Men's full scale scores were higher than women's, and only men exhibited an increase. The women's pre- and posttest scores appeared more stable. Internal reliability coefficients and test-retest reliability coefficients for both the full scale scores and the subscale scores were very adequate, but the men's scores did increase.

A major emphasis of creativity training has been the increase in those behaviors, skills, and abilities associated with creativity, creative performance, and productivity (Basadur, Graen, & Graen, 1982; Basadur, Wakabayashi, & Graen, 1990; Glover, 1981; Thorn, 1987). Previous research has focused on examining and establishing the possibility of increasing creativity as a result of deliberate training (Feldhusen, Speedie, & Treffinger, 1971; Parnes & Meadow, 1959, 1960; Parnes & Noller, 1972; Torrance, 1987). Kirton and other researchers have pointed out the importance of separating style from creativity (Goldsmith, 1987; Isaksen & Puccio, 1988; Masten & Caldwell-Colbert, 1987). In particular, Kirton (1978, 1987) asserted that his measure of creative style was completely independent from influences of technique used and training.

In light of the style-level controversy, the orthogonality of the Kirton Adaption-Innovation Inventory from measures of level and training effects can be more productively examined if the stability of the inventory is confirmed. The purpose of the current study was to extend previous research on training effects and the stability of the Kirton inventory by examining the

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impact of creativity training on KAI total and subscale scores. A second, related objective concerned providing more extensive data on test-retest reliability and internal reliability that included subscale data.

In an analytic review of the first ten years of research on adaption-innovation theory, Mudd (1986) noted the importance of continued systematic development of research on the Kirton Adaption-Innovation Inventory and identified several directions for further development. He commented that "To promote developmental training and other types or repeated measure designs the test-retest reliability of the KAI should be established for the full scale and sub-scales" (p. 123). He further suggested the use of more powerful analytic techniques to examine the single and combined effects of the subscales.

Kirton's theory of adaption and innovation (1976, 1987) and measure, the Kirton Adaption-Innovation Inventory (1982), describe different cognitive styles of problem-solving and decision-making. Kirton has proposed a continuum from adaption to innovation based on the strength of preference that individuals express over time for solving problems within a defined paradigm or for redefining a given paradigm. A basic distinction between the two styles lies in an adaptive preference to improve, modify, or make existing things better or an innovative preference to change the way things are by doing them differently. The adaptive-innovative dimension is assumed to be a relatively permanent personality characteristic and, as such, immune to change through training (Goldsmith, 1989).

Kirton (1987) indicated that these distinctions in style preference presume three subconstructs identified in subscales within the inventory: (a) Sufficiency vs Proliferation of Originality (the extent to which individuals prefer to produce original ideas), (b) Efficiency (the extent to which individuals are concerned with precision, reliability, and efficiency), and (c) Rule-Group Conformity (the extent to which a person is methodical, prudent, and sensitive to conformity pressures).

Development of the Kirton instrument using repeated measures is limited, and initial work has focused on total scores. In prior research Kirton (1989) reported four studies on test-retest reliability. Of these four, only his initial study (Kirton, 1978) and the Gryskiewicz, Hills, Holt, and Hills (1987) results are easily accessible. The additional test-retest studies Kirton (1989) cited, by Prato Previde with Italian managers and by Pottas with South African students, are unpublished. Kirton (1989) reported reliability coefficients of .82 and .84 for the published studies and .86 for the unpublished Prato Previde study. The unpublished South African study contained pretest and posttest means only (91.2 and 91.1).

More recently, Goldsmith and Kerr (1991) examined training effects of entrepreneurship on the stability of the inventory and extended test-retest

development on total scores with a small sample of American undergraduates. They found no evidence of a training effect. They reported internal consistency reliability coefficients of .82 (pretest) and .74 (posttest) for an experimental group ($n = 34$), and .83 (pre- and posttest) for a control group ($n = 24$). Their test-retest coefficient was .69.

The purpose of the current study was to extend previous research on training effects and the stability of the Kirton inventory by examining the impact of creativity training on KAI total and subscale scores. A second, related objective concerned providing more extensive data on test-retest reliability and internal reliability that included subscale data.

METHOD

Subjects

Subjects were 143 undergraduates enrolled in eight sections of an introductory course on creativity in a mideastern college during the fall of 1989 and an additional group of 38 students from a general marketing class in the business department on the same campus. Total population of undergraduates on the campus was 10,520; mean age of the population was 21.5 yr. (men) and 21.4 yr. (women). Mean ages of this sample were 21.1 yr. (men) and 21.6 yr. (women). The creativity course was a general education elective without prerequisites and was open to any student by self-selection. The business course was a general marketing course for business majors.

Procedure

The present study used a pretest/posttest nonequivalent control group design to measure the effects of creativity training in the classroom. It was a part of a larger exploratory examination in creativity that used a variety of instruments in a classroom context (Dorval, 1990; Isaksen, Dorval, & Kaufmann, 1991). From eight sections of an introductory creativity course 143 subjects completed Kirton's measure during the second week of class in the fall semester of 1989. A second administration occurred 14 weeks later in early December.

The purpose of the creativity course was to provide awareness and understanding of creativity in four general areas: creative process, creative person, creative press or environment, and creative product. This course is designed to give knowledge, but it is also designed to introduce the students to specific guidelines and techniques of Creative Problem Solving. The course has been shown through a variety of previous research studies to affect level of creativity (see Parnes, 1987). Given that this training affects level of creativity and the previous assertions that the Kirton inventory ought to be impervious to technique training, then this course is appropriate to test the hypothesis that the Kirton instrument is a stable measure of creative style.

The creativity classes met twice weekly for one hour and fifteen min-

utes. Individual Kirton inventory scores, an explanation of theoretical concepts, and practical applications for using style information with individuals and groups were provided students six weeks into the course in conjunction with information about the creative person.

Thirty-eight subjects enrolled in a general marketing course also completed the inventory at the beginning of the semester. Individual scores, an explanation of theoretical concepts and practical applications for using style information with individuals and groups were provided after the posttest at the end of the semester.

RESULTS AND DISCUSSION

Total Scores

Table 1 presents the descriptive statistics for women and men in both the experimental ($n = 143$) and control ($n = 38$) groups. It includes both KAI total scores and the three subscale scores (Originality, Efficiency, and Rule Conformity).

A $2 \times 2 \times 2$ Lindquist Type III analysis of variance was performed on the KAI total scores and each of the three subscale scores. For analysis of

TABLE 1
DESCRIPTIVE STATISTICS FOR SCORES ON KIRTON ADAPTION-INNOVATION INVENTORY
FOR EXPERIMENTAL AND CONTROL GROUPS BY GENDER

Kirton Inventory	Women					
	Creativity ($n = 105$)			Business ($n = 27$)		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
Total Score						
Pretest	97.4	13.3	71-136	97.0	15.0	66-128
Posttest	98.3	15.4	65-134	98.0	16.1	70-150
Originality						
Pretest	41.7	7.7	24-60	42.0	8.8	24-54
Posttest	43.2	7.6	25-61	43.1	7.5	29-55
Efficiency						
Pretest	19.4	4.9	7-31	18.9	5.1	7-28
Posttest	18.7	4.8	7-31	18.9	4.9	8-31
Rule Conformity						
Pretest	36.3	6.5	23-54	36.1	6.0	26-48
Posttest	36.4	7.5	19-56	36.0	7.4	25-50
				Men		
				Creativity ($n = 38$)		Business ($n = 11$)
Total Score						
Pretest	102.4	15.6	75-146	101.1	14.0	75-120
Posttest	105.8	16.9	80-156	106.0	18.1	79-140
Originality						
Pretest	43.2	7.6	28-63	46.1	6.6	38-60
Posttest	45.6	7.6	33-64	47.8	7.8	38-64

(continued on next page)

TABLE 1 (CONT'D)
 DESCRIPTIVE STATISTICS FOR SCORES ON KIRTON ADAPTION-INNOVATION INVENTORY
 FOR EXPERIMENTAL AND CONTROL GROUPS BY GENDER

Kirton Inventory	Men					
	Creativity (<i>n</i> = 38)			Business (<i>n</i> = 12)		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
Efficiency						
Pretest	20.7	4.7	13—31	17.8	5.4	9—28
Posttest	20.7	5.1	9—34	18.8	4.3	11—25
Rule Conformity						
Pretest	38.5	8.5	20—56	36.2	7.4	22—48
Posttest	39.6	8.1	26—58	39.4	8.8	22—53

both total scores and the three subscale scores, the two between-subjects' variables were groups (creativity and business) and gender (men and women). The within-subjects' variable was the pretest-posttest condition.

The analysis of KAI total scores gave no significant main effect on groups; see Table 2. There was no evidence of a training effect for creativity. This finding supported Goldsmith's (1989) position that the Kirton inventory measures a stable personality characteristic as well as Goldsmith and Kerr's (1991) findings that entrepreneurship training did not affect subjects' KAI total scores.

TABLE 2
 ANALYSIS OF VARIANCE OF TOTAL SCORES ON KIRTON ADAPTION-INNOVATION INVENTORY
 BETWEEN GROUPS AND GENDER ACROSS PRETEST-POSTTEST CONDITIONS

Source	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>
Groups	1	24.31	24.31	.06
Gender	1	1707.71	1707.71	4.11*
Groups × Gender	1	6.59	6.59	.02
Error	177	73,623.38	415.95	
Pretest-Posttest	1	396.87	396.87	10.67*
Groups × Pre-Post	1	20.07	20.07	.54
Gender × Pre-Post	1	163.17	163.17	4.39*
Groups × Gender × Pre-Post	1	16.99	16.99	.46
Error	177	6580.53	37.18	

**p* < .05.

There was, as has been previously reported (Kirton, 1987), a significant main effect for gender (women's *M* = 97.8, *SD* = 14.5; men's *M* = 103.9, *SD* = 16.1) and the pre- and posttest condition (pretest *M* = 98.5, *SD* = 14.1; posttest *M* = 100.3, *SD* = 16.2). There was also a significant interaction for gender by pre-posttest. Pretest and posttest means for men were 101.9 (*SD* = 15.1) and 105.9 (*SD* = 17.0); pretest and posttest means for women were 97.3 (*SD* = 13.6) and 98.3 (*SD* = 15.5). A Newman-Keuls test applied to the means indicated that the men's posttest mean was significantly higher than

their pretest mean ($p < .05$). Also, the men's pretest mean and posttest mean were significantly higher than the women's pretest mean ($p < .05$) and posttest mean ($p < .05$). However, the women's pretest and posttest means were not significantly different. On the average, men scored higher than women and also exhibited a systematic pretest-posttest increase in their scores that women did not. It appeared that stability of KAI total scores was indicated for the women's group but not in the men's group.

Subscale Scores

In addition, a $2 \times 2 \times 2$ Lindquist III analysis of variance (groups, gender, pre-posttest) was performed on each of the subscales. The analysis of the Efficiency subscale scores yielded no significant results. The Efficiency subscale appeared to be stable and exhibited no gender differences. Analysis of the Originality subscale scores showed two significant effects: gender ($F_{1,177} = 4.68, p < .05$) and pre-posttest ($F_{1,177} = 9.24, p < .05$). For Originality the men's mean was 44.9 ($SD = 7.5$) and the women's mean was 42.5 ($SD = 7.7$). On the repeated variable the posttest mean ($M = 43.9, SD = 7.7$) was only slightly higher than the pretest mean ($M = 42.3, SD = 7.8$). In general, it appeared that on Originality men scored slightly higher than women and that their scores increased slightly from pretest to posttest.

Analysis of the Rule Group Conformity subscale scores yielded two significant results: a pretest-posttest effect ($F_{1,177} = 4.49, p < .05$) and an interaction of gender by pretest-posttest ($F_{1,177} = 4.28, p < .05$). A Newman-Keuls test applied to the Rule Group Conformity means indicated significant differences between the men's and women's pretest means ($M = 38.0, SD = 8.3$ vs $M = 36.2, SD = 6.4, p < .05$) and their posttest means ($M = 39.6, SD = 8.1$ vs $M = 36.3, SD = 7.5, p < .05$). There was no significant difference between either the men's pretest and posttest means or the women's pretest and posttest means. In general, men scored higher than women on Rule Group Conformity, but both men and women were stable on this dimension over the pretest-posttest condition.

Table 3 shows both Cronbach's alphas and test-retest reliabilities for the KAI total scores and subscale scores. The coefficients alpha for the pretest and posttest KAI total scores were very similar to those reported by Goldsmith and Kerr (1991) and Kirton (1978). The coefficients alpha for both total scores and subscales scores were very adequate (range = .73 to .93). Pearson correlations between the two administrations of the inventory were also very adequate. For the full scale the test-retest coefficients for men and women were .83 and .87, respectively. For the subscales test-retest coefficients for men and women ranged from .67 to .80. These data give evidence of the internal consistency and test-retest reliability of the inventory and its subscales.

TABLE 3
 RELIABILITY ESTIMATES (CRONBACH ALPHA) AND 14-WEEK TEST-RETEST RELIABILITY OF
 KIRTON ADAPTION-INNOVATION INVENTORY TOTAL AND SUBSCALE SCORES
 BY GENDER ACROSS PRETEST AND POSTTEST CONDITIONS

Kirton Inventory	Women (<i>n</i> = 132)			Men (<i>n</i> = 49)		
	Cronbach α		Test-Retest <i>r</i>	Cronbach α		Test-Retest <i>r</i>
	Pretest	Posttest		Pretest	Posttest	
Total	.81	.87	.83*	.85	.90	.87*
Originality	.80	.81	.74*	.80	.82	.76*
Efficiency	.73	.76	.80*	.74	.77	.67*
Rule Group	.70	.87	.75*	.82	.84	.79*

* $p < .001$.

Conclusions

Data from this study provided additional, explicit information regarding stability of the instrument and its subscales. The findings lend support to the over-all stability hypothesis put forward by Kirton (1976) and others (Goldsmith, 1989). Internal consistency and test-retest reliability for both the total and subscales provide evidence of the inventory's adequacy.

Some limitations in this study, however, should be considered. Although results indicate sufficient significant findings regarding interactions with gender on the full and subscales to warrant further investigation, similar differences between men's and women's scores have been noted (Kirton, 1987). Also, gender of examiners was not investigated for possible influence. Information regarding subjects' scores was presented to the creativity group nine weeks before the second administration of the inventory and may have influenced responses. Further, the size of the control population warrants caution for generalizability.

Over the last decade the Kirton Adaption-Innovation Inventory has been a useful personality measure to assist in understanding individual, group or organizational problem-solving and decision-making. In regard to the instrument's application in creativity training, a major area of usefulness lies in the depth of information it provides to individuals and groups who are interested in using their creativity more effectively in problem solving and decision-making (Isaksen, 1991). Group and organizational change resulting from increased understanding of adaptive-innovative style preferences begins with accurate information about the individual, but, if detailed and elaborated upon, can be useful in more complex situations. Although total scores provide useful data for broad interventions, use of those data alone can overlook more detailed distinctions that are important for application in groups (Rosenfeld, Winger-Bearskin, Marcic, & Braun, 1993). On-going, systematic research and development of both the theory and the measure can continue to increase its utility, particularly in regard to more deliberate understanding and use of the subscales and their gender implications.

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