A STUDY OF THE RELATIONSHIP BETWEEN COGNITIVE AND NONCOGNITIVE MEASURES OF CREATIVITY AND LOCUS OF CONTROL, SAT, AND GENDER

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Abstract

The present study was designed to investigate the relationship between a cognitive and a noncognitive measure of creativity (the RAT and the BWAS, respectively) as a function of locus of control, intelligence, and gender.

Subjects were administered the two measures of creativity and the Rotter Internal-External Locus of Control Scale. SAT scores were also obtained.

It was predicted that (a) the RAT and the BWAS would not be significantly related; (b) the RAT and the BWAS would be positively related to SAT; (c) high creative subjects on both measures of creativity would obtain a more internal locus of control score.

Significant Pearsonian correlations were obtained for (a) RAT x BWAS for males; (b) RAT x SAT overall; (c) BWAS x SAT overall; (d) BWAS x LOC for males and females. The results of 2 x 2 analysis of variance show (a) a significant interaction between the BWAS and sex on LOC scores; (b) a significant main effect of the RAT on SAT scores; (c) a significant interaction between the RAT and LOC on SAT scores.

Results were discussed within the context of sex differences and general low population scores on the creativity measures and on LOC.

Difficulty in the interpretation of results of creativity research is embellished by the lack of an accepted standard definition of the construct. Much of the early research on creativity has assumed a variety of cognitive, or intellectual, approaches to measurement. Guilford's (1959) "Structure of Intellect" model is one such cognitive approach to creativity. This model is based on the parameters of operation, product, and content, each of which is divided into categories. There are five operations, six products, and four classes of content. This yields one hundred twenty different areas of intellect, each of which is represented by a specific and separate test. Three of the five operations - cognition, convergent production, and divergent production - relate to the measurement of creativity. The primary cognitive abilities as defined by Guilford are associated with the "possession of information - its discovery and rediscovery." Cognition is therefore used in a limited sense under the broad heading of intellectual abilities. Convergent production presupposes the most conventional answer to a problem. It comprises that ability tapped by conventional intelligence tests. Divergent production refers to thinking that "goes off in different directions" - an ability often curbed on standard intelligence tests. Guilford's model merely differentiates between standard intelligence tests and those requiring ingenuity by referring to them as convergent and divergent tests, respectively. Abilities of the divergent category have previously remained foreign to intelligence tests and most conceptions of intelligence.

Getzels and Jackson (1962) also approach the study of creativity cognitively by stating that there are two basic cognitive or intellectual modes. One "tends toward retaining the known, learning the predetermined, and conserving what is." The other mode "tends toward revising the known, exploring the undetermined, and constructing what might be." The latter represents the creative mode and is included as a definite cognitive function.

Mednick (1962) developed a creativity test, the Remote Associates Test, requiring the subject to "form associative elements into new combinations by providing connective links." Scoring criteria requires specific combinations of elements. The Remote Associates Test (RAT) of Mednick and Mednick (1967) is similar to conventional intelligence measures in the area of convergent thinking. Respondents are required to provide a one word response with associated elements to three stimulus words. A predetermined scoring criteria was validated on populations independently identified as creative.

Paul Torrance (1962) developed a cognitive approach to creativity using both verbal and nonverbal stimuli called the "Minnesota Tests of Creative Thinking" (MTCT). Research using the MTCT battery has indicated no correlation between the verbal and nonverbal sections and a lack of independence from conventional intelligence tests (Wallach and Kogan, 1965). Madaus (1967) discovered three factors present in the MTCT battery: verbal divergent thinking, nonverbal divergent thinking, and intelligence. He concluded that it is not clear that the battery actually consists of a separate underlying dimension distinct from intelligence. Welsh (1975) suggested that

the cognitive tests mentioned above are incapable of measuring creativity as a factor independent of intellectual ability. Tests that purport to measure creativity, Welsh adds, should be positively intercorrelated with each other and should be relatively independent of measures of intelligence. The finding that the tests used by Getzels and Jackson and others are as highly correlated with intelligence tests as with each other evokes a certain lack of confidence regarding methodology and conclusions derived from research on creativity.

The search for an easily administered test of creativity that is independent of traditional tests of intelligence has not been a rewarding one as long as the cognitive philosophy has dominated the instrument design. It is for this reason that Barron and Welsh (1952) began their studies with the Barron-Welsh Art Scale (BWAS) - a figure preference test. Their goal was to establish the validity of a noncognitive approach to the measurement of creativity by correlating it with the personality characteristics of the creative person. Research has yielded significant correlations between scores on the Art scale and several independent criteria of creativity.

The Institute for Personality Assessment and Research (IPAR) in Berkeley was organized as a "living-in" assessment method to study creativity from a personality viewpoint. A number of studies done at IPAR summarized by Barron (1969) have used artists and musicians nominated as being creative and widely recognized in their field. Validation studies involving personality characteristics associated with creativity included concepts such as aesthetic interests,

originality, independence, and personal complexity. In a study investigating the originality of military officers using the BWAS and a series of experimental tasks, a clear cut difference was shown between subjects performing the most original and the least original on the tasks. Welsh (1975) summarizes the attributes characteristic of high scorers on the BWAS as creative, original, nonconforming, unconventional, independent, impulsive, radical, daring, and self-directed.

Creativity and Intelligence

Torrance (1971) summarized all evidence available through 1967 on creativity and intelligence. He estimated a median correlation of .20 between scores on creativity tests and intelligence tests. The scores on the creativity tests were also grouped according to whether the test was mainly verbal or nonverbal. The median correlation coefficient between verbal creativity and intelligence was found to be .21. The correlation between nonverbal creativity and intelligence was .06. McNemar (1964) pointed out that the low correlation between creativity and intelligence may be a statistical artifact due to the restricted ability range of the samples studied. Nevertheless, Torrance's summary indicates a low general correlation between creativity and intelligence. That correlation is slightly higher for the verbal, cognitive measures than it is for the nonverbal, noncognitive measures of creativity.

Mednick (1962) found that the RAT was uncorrelated with the BWAS although it was correlated positively with intelligence measures.

Inconsistent and low correlations between scores on the BWAS and the RAT were found by Colman (1966) for small groups of college students. Mednick (1964) also reported an absence of significant correlations between the BWAS and the RAT for college samples. The question as to whether or not one should be able to obtain similar results in the identification of high and low creative subjects with the RAT, a cognitive measure of creativity, and the BWAS, a noncognitive measure, is raised. Other available research has not differentiated between existing creativity measures as cognitive or noncognitive, nor correlated them.

Independent research utilizing cognitive and noncognitive measures of creativity have obtained similar relationships between personality attributes and creativity. Torrance (1971) found that highly creative subjects are better able to cope with frustration than low creative subjects. Cohen and Oden (1974) have shown creatives to be more open to new experiences, to exhibit risk-taking behavior, and to be nonconforming.

Studies of the intelligent and gifted have indicated a positive relationship between intelligence and creativity. Gowan (1957) has shown intelligence to be a primary factor in achievement. In a later study he suggested that characteristics of high achievers include an individual aspiration to succeed, a general motivation to achieve, a belief in oneself, reasonable risk-taking, permissiveness, intraception, creativity, tolerance of ambiguity, and a belief in the "efficacy of human planning versus superstitious fatalism." Gowan (1970) defined giftedness in terms of potential to develop creativity. Giftedness, because it is defined by IQ, is potentiality.

From a noncognitive point of view, IPAR research has described the creative person as intelligent, original, independent, open, intuitive, aesthetically sensitive, highly energetic, dominating, possessing a sense of destiny, a sense of humor, and tolerance of ambiguity and complexity. The similarities between the personality characterisitcs of the creative individual as measured cognitively and noncognitively is obvious.

Creativity and Locus of Control

Persons scoring low in locus of control research have been described with personality characteristics similar to those obtained in creativity research. The characteristics of autonomy and self-direction (Angyal, 1941), nonconformity (Linton, 1955), risk-taking (Phares, 1962), independence and non-suggestibility (Rotter, 1966), have been noted.

Locus of control has two dimensions: internal and external. Rotter (1966) defines external locus of control as the belief that one's actions are the result of fate or chance, and are seemingly "unpredictable due to the great complexity of forces surrounding" the person. Reinforcement is seen as following one's action but is not totally contingent upon one's own action. Internal locus of control is defined by the belief that events in one's life are contingent upon one's own actions and behavior. Angyal (1941) has related internal locus of control to the significance of a person's motivation toward autonomy and self-direction. Field determinism (a dependence on cues from the environment) versus body orientation (a dependence

on cues from internal sources) has been shown to be characteristic of conforming people. The more field oriented person (external locus of control) is more conforming than those with a body orientation or an internal locus of control.

Phares (1962) related risk-taking to locus of control in his studies of perceptual thresholds for shock-associated stimuli in situations controlled by chance versus those attributed to skill. He concluded that those subjects who felt as though they were in control of the situation had perceptual behaviors that would better enable them to cope with situations that were of potential threat than those subjects who felt that noncontrollable or chance forces determined the success or failure of their behavior. On the characteristics of independence and suggestibility, Rotter (1966) states that internals would seem more resistive to manipulation from external sources than persons with an external locus of control. Studies by Strickland (1962) and Getter (1962) suggest that internals have a characteristic negativism to external manipulation particularly when one is aware that someone is attempting to manipulate him. The internal is not particularly resistive when given full conscious choice in the matter, i.e. personal, self-control of the situation.

Dickinson (1975) conducted research relating locus of control and self-reinforcement to creativity. She found that creativity as measured by the "What Kind of Person Are You?" test, and scores on the Rotter Locus of Control Scale are negatively related. Self-reinforcement was measured by the subjects' performance on an ambiguous task and subsequent self-reward with points. The subjects were divided

into high and low creatives and high and low self-reinforcers. Low reinforcers viewed a high self-reinforcing model and high self-reinforcers viewed a low self-reinforcing model. High creatives were found to be more self-reinforcing than low creatives and were less affected by the modeling of differential self-reinforcement.

Glover and Sautter (1976) studied the relationship of locus of control, as measured by the Rotter scale, to four components of creativity - fluency, flexibility, originality, and elaboration - as measured by Torrance's test of creativity. Data yielded non-significant differences on fluency. Internals, however, scored higher than externals on flexibility and originality. The externals were higher on elaboration than the internals.

On the basis of these findings, it is suggested in this study that an individual with an internal locus of control will exhibit more creative ability than a person who is externally oriented. It is obvious that there are characteristic similarities between personalities of creative and internal locus of control individuals.

Sex Differences

Inconsistent findings have been obtained with regard to sex differences in the areas of creativity and locus of control. Kogan (1974) summarized the literature on creativity and sex differences. He concluded that "neither sex is at an advantage in regard to 'creative potential,'" and the majority of studies in this area have not found a "systematic superiority of one sex over the other." Ibrahim (1976) also concluded that it is not possible to state the superiority of one sex over another on originality tests.

Rotter (1966) obtained no sex differences in his locus of control studies. Various studies summarized by Chandler and Dugovics (1977) have reported significant correlations between locus of control and sex for males but not for females.

It has been speculated by these sources in creativity and locus of control that sex differences may be a function of cultural expectations and norms and sex role differentiations. Men have been allowed freedom of expression whereas women have been encouraged to express themselves in conventional ways. Women have been expected to be less productive intellectually and creatively and less success-oriented than males. The current trend toward women's liberation may reveal hidden female talents and alter stereotypic personality traits often associated with the female sex. For these reasons, sex differences will be observed with respect to creativity and locus of control.

Statement of the Problem

It appears that the strength of the relationship between intelligence and creativity varies as a function of whether creativity is assessed with a cognitive or noncognitive instrument. Many reported personality characteristics of the creative individual appear independent of the type of creativity test employed. There is reason to believe that locus of control is related to creativity, but no research exists which reports findings relative to the type of creativity test employed.

It is hypothesized that the BWAS scores and the RAT scores will not be significantly related. The data reported is ambivalent in this

respect. It is suggested that both the RAT and the BWAS will correlate similarly with intelligence (SAT scores). The data implies a significant correlation between the RAT and intelligence, but not the BWAS. As both the RAT and the BWAS are correlated with similar personality variable, it is hypothesized that a negative correlation will be obtained with locus of control scores.

The present study will assess the relationship between cognitive and noncognitive measures of creativity and the variable of locus of control, SAT scores, and sex.

Method

Subjects

The subjects were eighty students from three educational psychology classes and fifty students from two general psychology classes at Appalachian State University. Variables associated with SAT scores (transfer students without SAT scores and subjects who denied permission to scores) reduced the total number of subjects to ninety-eight. There were sixty-five females and thirty-three males. Class standing of the subjects ranged from freshman to senior.

Materials

The twenty-nine question Rotter Internal-External Locus of Control Scale (Rotter, 1966), the Barron-Welsh Art Scale (Barron and Welsh, 1952), and the Remote Associates Test (Mednick, 1962) were administered to each subject.

Procedure

The subjects were administered the tests as a group in the following order: (1) Rotter Internal-External Locus of Control Scale, (2) Barron-Welsh Art Scale (BWAS), and (3) the Remote Associates Test (RAT). Testing was completed within the one hour and twenty minute allotted time.

Instructions for each test were provided according to the respective test manuals. The subjects were also requested for their written permission to obtain their SAT scores from the ASU Registrar's Office. They were asked to sign a sheet beside their name and Social Security number if they were willing to comply with the request.

Pearsonian correlations were obtained with a MINITAB computer program. Analysis of variance was also used to analyze the factors of creativity (RAT and BWAS) and LOC, SAT, and sex.

Results

Pearsonian correlations, as listed in Table 1, were run between the variables of BWAS, RAT, SAT, and LOC for males, females, and combined scores. Although the BWAS and RAT were not significantly correlated for the total group scores ($r=.140$), a significant correlation was obtained between the RAT and the BWAS for males ($r=.279$, $p<.01$). Significant correlations were found for: (1) the RAT and SAT of .327 for the total group scores; (2) .318 for females, and (3) .391 for males ($p<.01$). A significant correlation of .411 ($p<.01$) was obtained between the BWAS and LOC for males, and a significant correlation of -.227 for the females.

Insert Table 1 about here

Figure 1 shows the manner in which the variables of SAT, LOC, and sex interact with creativity as measured by the BWAS.

Insert Figure 1 about here

Frame A shows the effect of the BWAS and sex on SAT scores. The top one-third and the lower one-third of the scores on the BWAS were used to define the high and low BWAS groups, respectively. The thirty subjects assigned to the high BWAS group had a mean score of 43.86, a standard deviation of 3.4, and a cutoff score of 40. The thirty subjects assigned to the low BWAS group had a mean score of 9, a standard deviation of 2.82, and a cutoff score of 20. Fifteen subjects were assigned to each cell of a 2 x 2 (creativity and sex)

factorial design. The apparent elevation of SAT scores by the high creativity group as compared to that of the low creativity group was not supported statistically by an analysis of variance main effect.

Frame B shows the effect of the BWAS and sex on LOC scores. Subjects were assigned to the cells of a 2 x 2 factorial design for the BWAS as in Frame A. A LOC score of above twelve denotes an external LOC and below twelve denotes an internal LOC (Rotter, 1966). A 2 x 2 between groups analysis of variance yielded a significant interaction ($F_{1,56} = 6.58$, $p < .05$) which supports the graphical impression that high creative females were more internal whereas low creative females were more external. High creative males and low creative males both obtained scores in the internal range of LOC and did not differ from each other.

Frame C exhibits the effect of the BWAS and LOC on SAT scores. Subjects were assigned to the cells of a 2 x 2 factorial design for the BWAS as in Frames A and B. The top one-third and the lower one-third of the scores on the LOC scale were used to define the external and internal groups, respectively. Subjects assigned to the external group had a mean score of 17.8, a standard deviation of 2.0, and a cutoff score of 16. Subjects assigned to the internal group had a mean score of 6.2, a standard deviation of 1.2, and a cutoff score of 8. A between groups analysis of variance supported the apparent lack of effect of the BWAS and LOC on SAT scores.

Figure 2 shows the manner in which the variables of SAT, LOC, and sex interact with respect to the more cognitive measure of creativity, the RAT.

Insert Figure 2 about here

Frame A shows the effect of the RAT and sex on SAT scores. The top one-third and the lower one-third of the scores on the RAT were used to define the high and low RAT groups, respectively. The thirty subjects assigned to the high RAT group had a mean score of 16.8, a standard deviation of 1.58, and a cutoff score of 15. The thirty subjects assigned to the low RAT group had a mean score of 1.13, a standard deviation of .83, and a cutoff score of 2. Fifteen subjects were assigned to each cell of a 2 x 2 (creativity and sex) between groups factorial design. Analysis of variance yielded no significant main effect or interaction.

Frame B shows the effect of the RAT and sex on LOC scores. Subjects were assigned to the cells of a 2 x 2 factorial design for the RAT as in Frame A. Once again, analysis of variance yielded no statistically significant findings.

Frame C shows the effect of the RAT and LOC on SAT scores. Subjects were assigned to the cells of the 2 x 2 factorial design as in Frames A and B. The top one-third and the lower one-third of the scores on the LOC scale were used to define the external and the internal groups, respectively. Subjects assigned to the external group had a mean score of 19.4, a standard deviation of 2.39, and a

cutoff score of 16. Subjects assigned to the internal group had a mean score of 6.8, a standard deviation of .74, and a cutoff score of 8.

Between subjects analysis of variance yielded a significant main effect of the RAT on SAT scores ($F_{1,56} = 7.665$, $p < .05$) and a RAT by LOC interaction ($F_{1,56} = 4.94$, $p < .05$). A Student's t-test yielded a significant difference between the means of the low RAT group for the internals and externals ($t_{15} = 2.28$, $p < .05$).

Discussion

The present research was designed to study the relationship of LOC, SAT, and sex to a noncognitive measure of creativity, the BWAS, and a cognitive measure of creativity, the RAT.

The finding that the RAT and the BWAS were not significantly correlated for the total group scores was supported by the literature (Mednick, 1962; Mednick and Mednick, 1964; Colman, 1966). A low positive correlation was obtained for the RAT and the BWAS for males. This is explained by the lower male mean scores on both measures of creativity, and the fewer number of males from which to sample. A literature review indicated a significant relation between the RAT and intelligence (SAT scores), and a lower correlation between the BWAS and intelligence (Welsh, 1975). The data obtained indicated that both measures of creativity were correlated with SAT scores. The correlations for the BWAS and SAT scores were slightly lower than those for the RAT and SAT scores. This finding supports the difference in cognitive emphasis of the two measures of creativity. Further support is obtained via an analysis of group data which indicated that the low RAT group had lower SAT scores than the high RAT group.

The hypothesis regarding the relationship between creativity and LOC stated that high creatives should obtain a more internal LOC and low creatives more external. A significant negative correlation was obtained between the BWAS and LOC for females indicating that high creative females were more internal than low creative females. This is supported by the literature (Dickinson, 1975; Glover and Sautter, 1976) which implies similar personality characteristics among highly

creative individuals and those with an internal locus of control. A low significant positive correlation was found for males between the BWAS and LOC suggesting that highly creative males are more external than low creative males with a noncognitive measure of creativity. A significant interaction effect was obtained for the BWAS and sex on LOC scores. High creative females were found to be more internal and low creative females tended toward an external LOC. No significant difference was obtained for the males.

There may be several explanations for the sex differences obtained. Primarily, as noted in Figure 1, Frame B, there was little variance in LOC scores for males and females when divided into the top and bottom thirds of the BWAS scores. All LOC scores fell quite close to the accepted cutoff score of twelve for internal and external LOC. Neither sex obtained extreme scores in either direction. As stated previously, the literature reports no consistent findings for sex differences and LOC.

No significant Pearsonian correlations were obtained between the RAT and LOC, as there were for the BWAS and LOC. This is due, perhaps, to the cognitive, intellectual nature of the RAT as opposed to the more intuitive, noncognitive nature of the BWAS. LOC tends to measure intuitive, perceptive, noncognitive rather than cognitive characteristics. A significant factorial interaction of the RAT by LOC with regard to SAT scores was obtained in the low RAT groups. The externals in this group had lower SAT scores than the internals. This finding is difficult to explain. There appears to be no data available with respect to a significant relationship between LOC and intelligence,

specifically SAT scores. The interaction could be a function of the overall low RAT scores for the population. The mean RAT score ($\bar{X}$ = 8.3) was considerably lower than other college undergraduates which ranged from 13.14 to 19.30 (Mednick and Mednick, 1967). This accounts for the low cutoff scores. The RAT scores may have been confounded by a lack of motivation and fatigue on the part of the subjects. The RAT was the final test administered in the series. These factors may be responsible for the low scoring sample obtained and subsequent group placement. The overall mean BWAS score for the population ($\bar{X}$ - 24.4) was also low, particularly when compared to the accepted cutoff score of 30 for high and low creatives. The unequal number of males and females (M = 33, F = 65) posed a difficulty in grouping by sex as it limited the population from which to select males.

It is suggested that a larger sample be used, equal sex groups be obtained, and test administration order be varied to control for the confounding effects of fatigue and lack of motivation.

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Table 1

Correlations

Group		
RAT r BWAS	.140	
RAT r LOC	.081	
RAT r SAT	.327 *	$p < .01$
BWAS r LOC	.015	
BWAS r SAT	.224 *	$p < .05$
LOC r SAT	-.005	
Females		
RAT r BWAS	.023	
RAT r LOC	.063	
RAT r SAT	.318 *	$p < .01$
BWAS r LOC	-.227 *	$p < .05$
BWAS r SAT	.214 *	$p < .05$
LOC r SAT	.042	
Males		
RAT r BWAS	.279 *	$p < .01$
RAT r LOC	.013	
RAT r SAT	.391 *	$p < .01$
BWAS r LOC	.411 *	$p < .01$
BWAS r SAT	.284 *	$p < .01$
LOC r SAT	-.097	

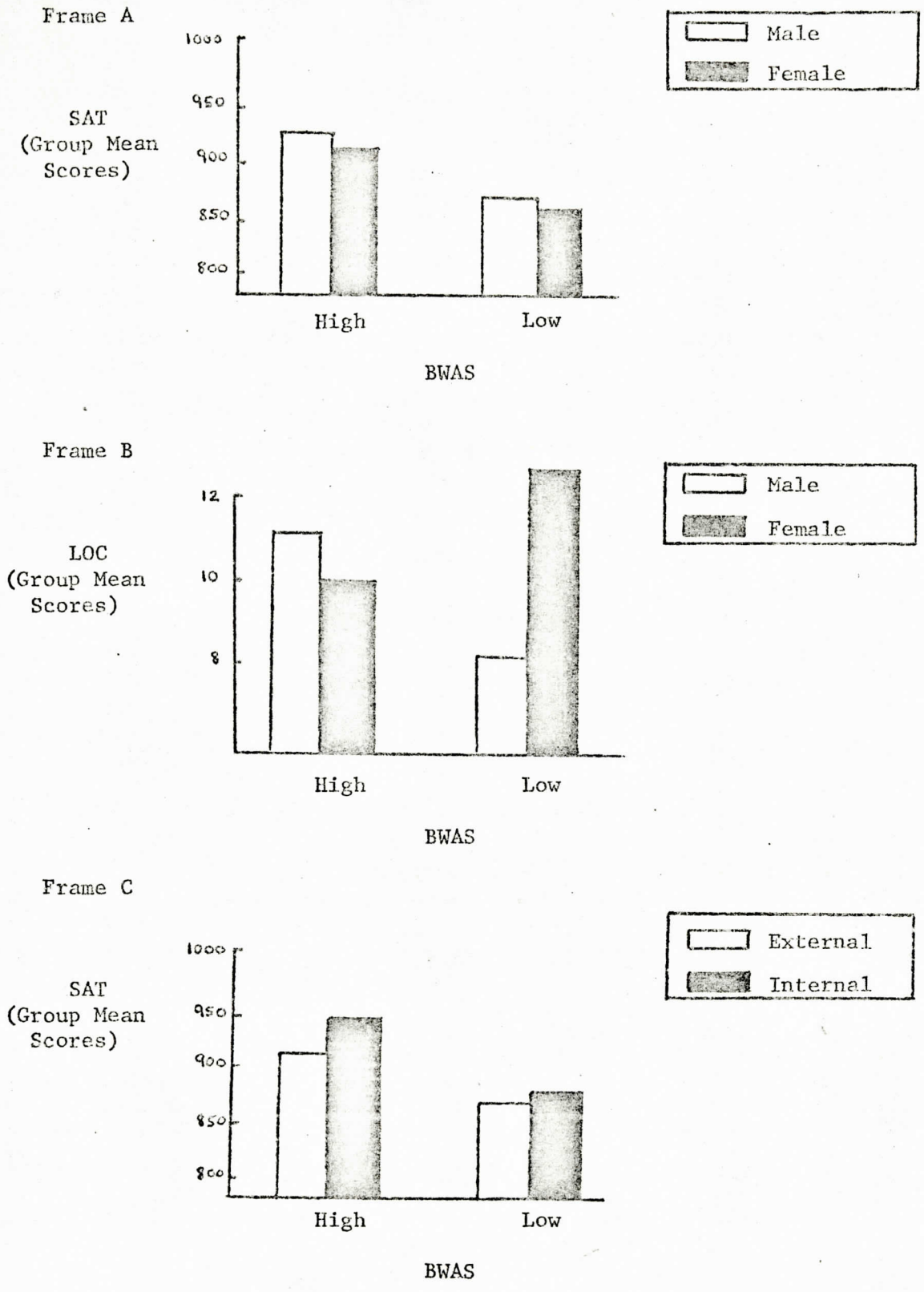

Figure 1: Creativity as measured by BWAS: Interaction with SAT, LOC, and sex.

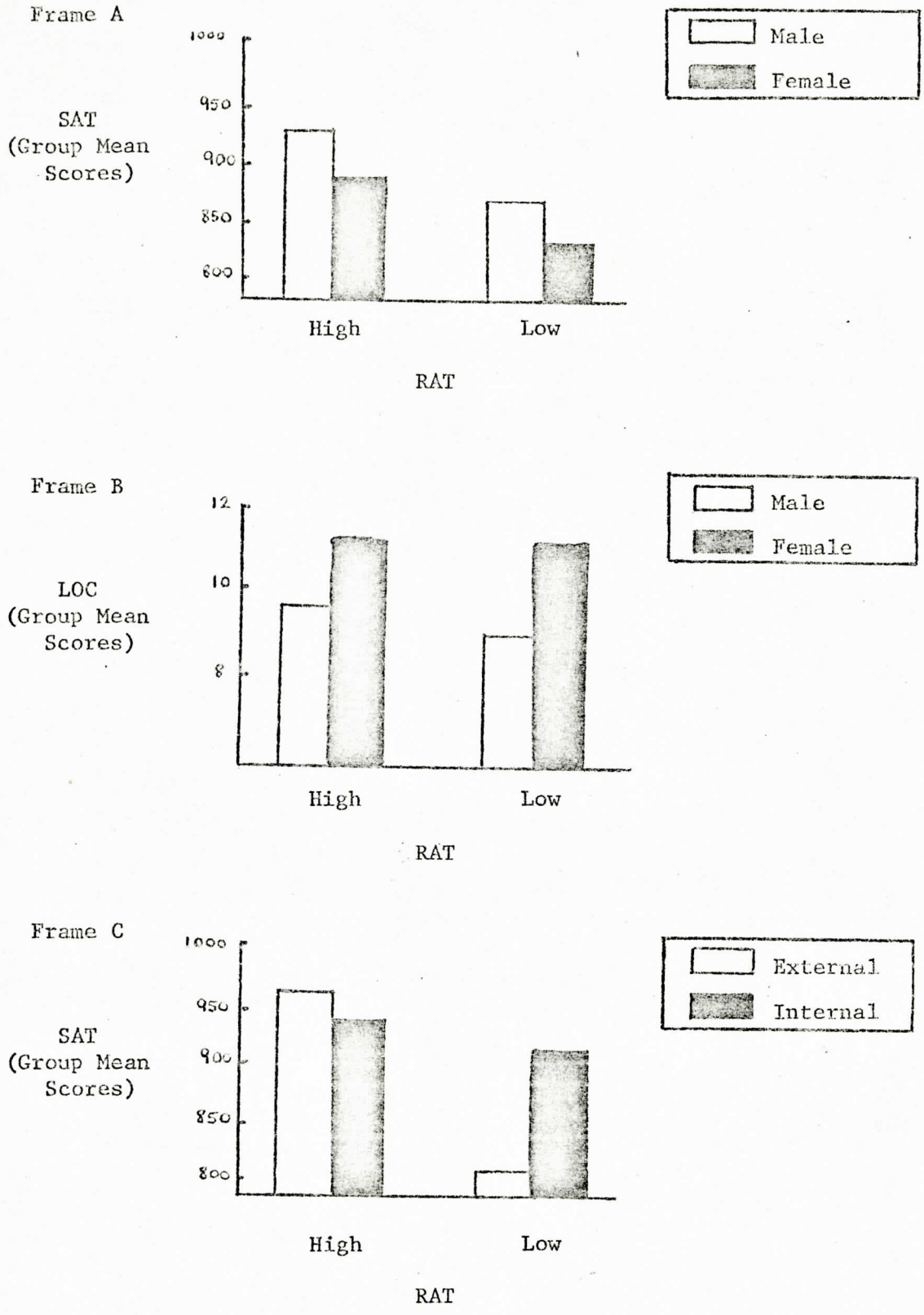

Figure 2: Creativity as measured by RAT: Interaction with SAT, LOC, and sex.