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ABSTRACT

The purpose of this study is to clarify further the relationships among creative, cognitive, and affective production of students. Thirteen pairs of twins, eight monozygotic (MZ), five dyzygotic (DZ), were administered the Torrance Tests of Creative Thinking, MMPI, and Revised Beta Examination. The F ratio for testing significance of within-set variances of MZ and DZ twins did not reveal heredity to be a significant factor in creative output. Significant correlations are reported between verbal fluency and hysteria and between depression and figural fluency and figural originality. Numerous significant correlations occurred between measures of intelligence and creativity and among constructs of creativity. Conclusions were: (a) measures of creative thinking do provide data on students in addition to that furnished by tests of intelligence, (b) factors other than heredity influence creativity, and (c) creative ability is diffuse as well as specific and is related to certain measures of intelligence. (Author)

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# Creativity in Monozygotic and Dyzygotic Twins

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## Creativity in Monozygotic and Dyzygotic Twins

The question of why some pupils succeed in education whereas others do not remains a perplexing problem that challenges educators, counselors, psychologists, social workers and the general public. Solutions to this problem often encompass the nature-nurture controversy suggesting either that ability may be more or less fixed by hereditary factors or that it is subject to change through specified environmental factors.

Vandenberg (1966) provides a comprehensive analysis of twin research. He notes that the relationship between heredity and physical characteristics is much easier to clarify than the relationships between the influence of heredity on cognitive and personality characteristics of individuals. Cattell (1963) suggests that cognitive abilities may be distinguished according to criteria of fluidity and crystallization.

He finds evidence that the more fluid cognitive abilities are more subject to influence from the environment. Gottesman (1962) found it possible to differentiate among types of neuroses with respect to their genetic components.

Although the genetic components of many abilities related to educational success have been explored, there is a scarcity of research dealing with the genetic determination of creative thinking.

There has been an increasing concern in recent years in understanding creativity. It is being explored as a possible technique for understanding abilities that relate to educational and occupational success. Several well known instruments have been derived in an effort to define, quantitatively and qualitatively, a construct of creativity.

Guilford (1950) refers to 1950 as the year generally regarded as the turning point with respect to an increased interest in creativity. He cites

several factors that contributed to this increase in interest. With respect to the relationship between IQ score and creativity score, Guilford has this to say:

> When the whole range of IQ is included, say from 62 to 150, there is a characteristic scatter plot. This plot shows that when the IQ is low, scores on tests of creative potential can only be low. When the IQ is high, there can be a wide range in performance on creative tasks, (Guilford, 1967, p. 9).

The purpose of the present study is to isolate variables that may contribute to the wide range in performance on creative tasks among students who are average or above average in intellectual ability. It was assumed that such variables might be classified under heritability, experiential, or personality factors. It was also posited that the nature of the tasks required by the intelligence test could shed light on the individual's performance on the creativity tasks.

## Method

Thirteen pairs of twins from metropolitan Atlanta and Athens, Georgia were selected as subjects. Eight of the pairs of twins were monozygotic or identical and five were dyzygotic or fraternal. The sample included the same number of males and females. The age range was from 16 years to 20 years of age and all Ss were engaged in post-high school education or had indicated an interest in training beyond high school. The average intelligence score for the subjects was approximately 110.

### Psychological Tests and Procedures

The tests administered were: 1) Revised Beta Examination, 2) Minnesota Multiphasic Personality Inventory (MMPI), and 3) Torrance Tests of Creative

Thinking, Verbal and Figural tests (Torrance, 1966). Data were also obtained regarding sex, zygosity, age and educational attainment for each of the twins.

The Revised Beta Examination as revised in 1957 by Robert M. Lindner and Milton Gurvitz uses non-language tasks to measure IQ. These tasks are labeled as Mazes, Digit Symbol, Error Recognition, Formboard, Picture Completion and Identities. The choice of a non-language IQ test was intended to meet the criticism that students tend to score about the same on written tasks whether they are labeled ability, achievement or even creativity tests.

MMPI was used because of its acceptability as a research instrument in the somewhat nebulous area of measurement of personality variables.

The Torrance Tests of Creative Thinking are comprised of two tests: Verbal and Figural. Each of these tests has two alternate booklets, A & B. Booklet A of each Test was used in this experiment. The Figural test consists of three tasks or activities labeled: 1) Picture Construction, 2) Picture Completion and 3) Parallel Lines. Each of the three tasks are scored for originality and elaboration as facets of the construct of creativity. In addition, the Picture Completion and Parallel Lines tasks are scored for fluency and flexibility. The Verbal test is comprised of seven tasks all of which are scored for fluency and originality. Six of these tasks are scored for flexibility and two may be scored for elaboration if desired. Because less than half of the verbal subtests yield an elaboration score, it was decided before beginning the experiment to omit the verbal elaboration score.

The F ratio as described by Block (1965) for testing the significance of the difference between the within-set variances of MZ and DZ twins was

computed by the formula:

$$F = \frac{6WDZ^2}{6WMZ^2}$$

The within-pair variance of identical twins is attributable to environmental influences while DZ within-pair variable reflects hereditary differences as well as environmental influences. A significant F indicates that heredity and environment produce greater differences in DZ twins than environmental influences alone do in MZ twins.

## Results

The significant findings in this study are summarized in the following tables. Table 1 reports significant intercorrelations among the creativity factors. Table 2 shows the significant correlations between creativity factors and scores on the Revised Beta Examination and Table 3 reveals significant relationships between creativity scores and scales on the MMPI. The analysis of variance was used to determine whether age, sex or zygosity were related significantly to creativity scores. No such relationship was found. The F test for equality of variances revealed no significant differences between the variance of MZ and of DZ twins.

## Interpretation and Summary

This study indicates significant differences among certain variables of creativity, personality, and intelligence of a group of adolescents achieving above average intelligence scores. Although none of the differences obtained on creativity measures were attributable to sex, age, or hereditary factors of the subjects, personality variableas did appear in significant relationship to creativity. If we assume that personality is acquired as the individual interacts with his environment then the positive relationship between

creativity and personality suggests an experiential base for creativity as well. The lack of correlation between hereditary factors and creativity reinforces the relationship between experience and creativity. Specifically, scores on figural fluency and figural originality were found to be positively related to the Depression scale on the MMPI. Verbal Fluency was found to be positively related to the Hysteria scale on the MMPI. It is not established that a causal relationship exists between these personality data and creativity scores. One possible explanation that suggests further experimentation is that persons demonstrating depressive tendencies as measured by the MMPI may have developed figural creative modes of expression whereas one scoring high on the Hysteria scale compensates through increased verbal fluency. This does not suggest reasons why the high-depressive is not high in all areas of figural creativity nor why the high-hysteria is not high in all areas of verbal creativity.

Considerably more significant correlations were found between creativity and intelligence factors than between creativity and personality variables. Creativity measures were found to measure different aspects of ability than those measured by the Digit Symbol and Identities subtests of the Revised Beta Examination. Only figural fluency and figural flexibility tasks of the creativity tests were found to lack significant correlation to the total score on the Revised Beta. These findings suggest that although a high-average intelligence group of students score high on creativity measures, they also show differentiation in creativity scores. Thus, creativity tests may be used in addition to intelligence testing to understand the individual's potential ability. More of the figural creativity scores than verbal creativity scores were significantly related to the Re-

vised Beta, a non-language intelligence test. This raises the question whether verbal creative tasks would be more highly correlated to a more verbal intelligence test. Perhaps a testing program making optimal use of verbal and non-language creativity and intelligence scales could be devised.

That not all measures of creativity are related significantly to all measures of intelligence lends support to Guilford's position, mentioned earlier in this paper, that there can be a wide range in performance on creative tasks when the intelligence score is high.

An intercorrelation matrix of subtests of the Torrance Creativity tests is reported in Table 1. It shows a high degree of correlation among the subtests supporting the thesis that a person who is creative in one area may possess a wide range of creative ability. The creativity tasks were not designed to measure discrete aspects of creativity but rather attempt to assess different outlets for creative expression. It is also recognized that the creative output of an average or below-average intelligence group of Ss could reveal very different results.

In conclusion, this study does reveal the utility of creativity tests in measuring abilities of those who score above the average on intelligence tests. No significant differences in creativity scores can be attributed to the sex, age, or zygosity of the Ss. It was not possible to show that hereditary factors are more or less influential than a combination of hereditary and environmental factors in producing a creativity score. There is a significant relationship between certain measures of personality and of creativity and a considerable tendency for creative ability to be manifested in several rather than a few discrete areas.

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Table 1

Significant Correlations Among Creativity

| | Figural Factors | | | | Verbal Factors | | |
|---|---|---|---|---|---|---|---|
| Figural | Fluency | Flexibility | Originality | Elaboration | Fluency | Flexibility | Originality |
| Fluency | | .94 | .86 | | .54 | .53 | .50 |
| Flexibility | | | .84 | | .62 | .58 | .60 |
| Originality | | | | .50 | .46 | | |
| Elaboration | | | | | | | |
| Verbal | | | | | | | |
| Fluency | | | | | | .89 | .95 |
| Flexibility | | | | | | | .85 |
| Originality | | | | | | | |

All correlations significant at .01 level.

Table 2

Significant Correlations Between Creativity Factors and Scores on Revised Beta Examinations

| | Revised Beta Scores | | | | |
|---|---|---|---|---|---|
| | Maze | Error Recognition | Formboard | Picture Completion | Total |
| Figural: | | | | | |
| Fluency | | | | .40 | |
| Flexibility | .40 | | | | |
| Originality | .41 | .39 | .44 | | .40 |
| Elaboration | | | .42 | | .41 |
| Verbal: | | | | | |
| Fluency | | | .46 | | .55* |
| Flexibility | | | .43 | .43 | .49 |
| Originality | | | .40 | | .53* |

*Significant at .01 level (others listed are significant at .05 level).

Table 3

Significant Correlations Between Creativity Factors and Scores on MMPI

| | MMPI | |
|---|---|---|
| | Hysteria | Depression |
| Figural: | | |
| Fluency | | .45 |
| Flexibility | | |
| Originality | | .50 |
| Elaboration | | |
| Verbal: | | |
| Fluency | .42 | |
| Flexibility | | |
| Originality | | |

Correlations listed are significant at .05 level (none other were significant).