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PREDICTION OF DIVERGENT THINKING AND CREATIVE PERFORMANCE
OVER A FOUR-YEAR PERIOD--A LONGITUDINAL STUDY.

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DESCRIPTORS- *ORIGINALITY, *CREATIVE THINKING, *CREATIVITY,
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STUDIES,

TO DETERMINE THE RELATIONSHIP OF SEVERAL DIVERGENT,
CONVERGENT, AND AFFECTIVE MEASURES ASSESSED IN JUNIOR HIGH
SCHOOL WITH DIVERGENT THINKING AND CREATIVE PERFORMANCE FOUR
YEARS LATER IN SENIOR HIGH SCHOOL, DATA WERE OBTAINED IN 1962
ON SEVENTH-GRADE CHILDREN CONCERNING IDEATIONAL FLUENCY AND
ORIGINALITY, SPONTANEOUS VERBAL FLEXIBILITY, CREATIVE TRAITS,
SCHOOL APTITUDE, AND ANXIETY. FOLLOW-UP DATA ON THE SAME
CHILDREN IN THE 11TH AND 12TH GRADES CONCERNED THE SAME
DIVERGENT THINKING TESTS, THE SAME CHECKLIST OF CREATIVE
TRAITS, AND TEACHER AND PEER NOMINATIONS FOR CREATIVE
ABILITY. RESULTS SHOW THAT (1) THE MEANS OF THE SCORES FOR
THE THREE DIVERGENT THINKING ABILITIES (IDEATIONAL FLUENCY,
ORIGINALITY, AND FLEXIBILITY) WERE ALL SIGNIFICANTLY GREATER
IN HIGH SCHOOL, AND (2) CREATIVITY SCORES DID NOT INCREASE OR
DECREASE SIGNIFICANTLY. A DISCUSSION OF THE RESULTS IS
INCLUDED. THIS PAPER WAS PRESENTED AT THE ANNUAL CONVENTION
OF THE AMERICAN PSYCHOLOGICAL ASSOCIATION (WASHINGTON, D.C.,
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PREDICTION OF DIVERGENT THINKING AND CREATIVE PERFORMANCE

OVER A FOUR-YEAR PERIOD: A LONGITUDINAL STUDY*

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Longitudinal and predictive studies of divergent thinking are needed to clarify the role of divergent thinking in creative performance. Taylor and Holland (1964) reviewed nine predictive studies and concluded that because of their short-range in time, long-range studies extending over several years or more are needed. They also concluded that the best predictors will be personality data, originality tests, aptitude and intelligence scores, biographical information, and self ratings of creative characteristics. Since most of the studies reviewed are single-predictor studies, Taylor and Holland suggest that efforts are also needed to identify the best sets or combinations of predictors of divergent thinking and creative performance.

Torrance (1962) reviewed longitudinal studies of creative thinking at each of the stages of child and adolescent development. However, for the high school level, he concluded that no true longitudinal studies of creative development could be found. A review of the studies included in Razik's recent

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comprehensive bibliography of creativity studies (1965) also failed to reveal any true longitudinal or long-range studies of creative thinking. However, it seems likely that data being gathered in several large projects such as Project Talent and the National Merit Scholarship Corporation will yield useful longitudinal data some time in the future.

The present research was guided by the assumption that divergent thinking abilities are cognitive functions which emerge in much the same way that convergent mental abilities emerge through interaction of the maturing organism with the cognitive demands of his environment, chiefly at school or in the middle-class home. Planned, systematic instruction in divergent thinking in the schools is still almost non-existent (Torrance, 1964). Thus, it is only in other areas of functioning such as in personal relations with teachers, parents, and peers or in unplanned efforts to cope with school demands that the student exercises the divergent thinking functions. Ideational fluency is the generation of a quantity of ideas for a problem, originality is the ability to produce unique or unusual solutions, and flexibility is the ability to shift categories in the production of ideas. These are the divergent abilities which were the focus of the present research. It was assumed that there was little or no teaching of these abilities to the students studied.

The purpose of the present research was to determine the relationship of several divergent, convergent and affective measures assessed in junior high school with divergent thinking and

creative performance assessed four years later in senior high school. The original study (Feldhusen, Denny, and Condon, 1965) was undertaken as a cross-sectional analysis and results were reported for relationships between SCAT, STEP, and anxiety on the one hand, and divergent thinking measures of ideational fluency, originality, and spontaneous flexibility which are represented by cells in Guilford's "structure of intellect" (1959). SCAT and STEP scores were found to be significant correlates of flexibility in seventh and eighth grade boys and girls and of originality in boys only. The present study is a followup of the same group of students.

METHOD

Data was obtained in 1962 for 239 children in seventh and eighth grades in a small city school system on the following: the Consequences Test (Christensen, Merrifield, and Guilford, 1960) which yields measures of ideational fluency and originality, the Alternate Uses Test (Christensen, Guilford, Merrifield, and Wilson, 1960) which yields a measure of spontaneous verbal flexibility, a creative traits checklist, SCAT, STEP, and anxiety (Sarason, et. al., 1960). Followup data was obtained in 1966 when the students were in eleventh and twelfth grades on the following: the same divergent thinking tests, the same checklist of creative traits, and teacher and peer nominations for creative ability. The peer nominations were obtained by having all students identify the five most creative boys and the five most creative girls in their class (11th and 12th grades). The following directions were given to students for the nominations:

We would like to have you think about all the students in your

class. Then try to identify the five boys and the five girls who are most creative. Here is a definition of creativity:

"Creativity is defined in various ways. Some people think of it as the ability to produce many ideas, to produce original or unusual ideas or things, or to be able to think in new and different ways. Others define creativity as artistic ability which may be shown in art, music, or dramatics. The creative individual may or may not be very popular."

Be sure to list only boys and girls who are in your class, that is who are juniors or seniors. List them in any order, not necessarily from most to least creative.

The score was then the total number of times a student was nominated by his peers. These scores were then converted to a six-point normalized scale to correct for abnormality of the distribution.

The teacher nominations were secured by having all teachers identify 5 to 20 each of junior and senior boys and girls. The following directions were given to the teachers:

We would like to have you think of all the students in the junior and senior classes. Then try to identify at least five junior boys, five junior girls, five senior boys, and five senior girls -- up to 20 in each category -- who are the most creative among their peers. Here is a definition of creativity:

"Creativity is defined in various ways. Some people think of it as the ability to produce many ideas, to produce original or unusual ideas or things, or to be able to think in new and different ways. Others define creativity as artistic ability which may be shown in art, music or dramatics. The creative individual may or may not be very popular."

List the creative youngsters in any order, not ranked according to creative ability. Please do not discuss your nominations with other teachers.

The divergent thinking tests, the checklist of creative traits, the anxiety scales, and the nomination instruments were administered and scored by the researchers¹ while SCAT and STEP scores were taken from the school records.

¹ See Appendix A

The checklist of creative traits yielded seven scores:

- (1) Factor I, derived from a factor analysis, socially conforming creative self view.
- (2) Factor II, socially non-conforming creative self view.
- (3) Factor III, energetic and dynamic creative self view.
- (4) Factor IV, diffident and/or withdrawing creative self view.
- (5) Total number of items checked on the checklist.
- (6) Score on items which are correlated with an objective measure of ideational fluency.
- (7) Score on items which are correlated with an objective measure of flexibility.

A sample of 211 students, 116 boys and 95 girls for whom complete 1962 and 1966 data were available was used.

Simple and multiple correlations were calculated among all the predictor variables assessed in junior high school and the criteria creativity variables assessed in senior high school. The multiple correlations were first calculated for all the predictors and then variables were removed one by one by the tear-down method. The optimum level at which the reduced set contained only significant predictors (probability for $X = .90$) and the shrunken R for that level were identified.

RESULTS

It should be noted first of all that the means for the divergent thinking scores were all significantly greater in senior high school than they were four years earlier in junior high school. Ideational fluency increased from 28.59 to 54.36, originality from 7.17 to 8.91, and flexibility from 13.25 to 20.01. None of the creativity.

checklist scores increased or decreased significantly.

The multiple correlations of variables assessed in junior high school with scores for divergent thinking, the checklist of creative traits and the nominations assessed in senior high school for boys and girls combined and separately are given in Table 1.

All of the multiple correlations (R) as reported in Table 1 were significant at or beyond the .05 level of significance except for the checklist (CR) fluency R which was not significant. However, it should be noted that the multiple R for the best set of predictors is often no larger than the R for the one best predictor. The multiple correlations of variables assessed in junior high (JH) with the creativity checklist scores assessed in senior high (SH) ranged from .20 to .39. The Rs for all Ss and for boys were quite similar in magnitude while the Rs for girls were generally higher, ranging from .32 to .51. As might be expected, checklist scores in JH were frequently the best predictors of SH checklist scores but SCAT, STEP, and anxiety, also appeared as significant predictors.

Multiple Rs for the divergent thinking scores of originality, ideational fluency, and flexibility were .55, .37, and .58 for all Ss; .51, .36, and .62 for boys; and .52, .52, and .67 for girls. For each SH criterion, its counterpart measure in JH was a significant predictor for all and for boys and girls separately.

The multiple Rs for peer nominations were .53, .53, and .57 for all, boys, and girls respectively. The predictors of peer nominations were the checklist conformity factor and SCAT and STEP scores.

The multiple R for teacher nominations were .58, .61, and .66 for all, boys, and girls respectively. Again checklist scores and SCAT and STEP were the best predictors.

Close examination of the simple correlations between JH variables and SH criteria scores revealed the following: (1) generally higher correlations for girls than for boys; (2) JH SCAT and STEP scores are better predictors of SH originality than the JH originality scores; (3) quite high correlations of JH SCAT and STEP scores with SH flexibility; and (4) JH flexibility, the checklist conformity factor, SCAT and STEP are all correlated with JH peer and teacher nominations.

DISCUSSION

The results suggest that the three divergent thinking abilities, ideational fluency, originality, and spontaneous flexibility, undergo significant and substantial growth from the junior high school age level to the senior high level or over a period of approximately four years. Since the most uniform experiences to which all these students were exposed were the events in school, it is reasonable to assume that the school has provided the instruction and/or experiences in which the abilities could grow. It might also be assumed that the divergent abilities emerge as a natural process of cognitive maturation and that the school had little effect. Finally, an interaction of the two positions may afford yet another explanation. Alternatively it is possible at this stage of the investigation to dismiss the gains as mere products of increased efficiency in speed in fulfilling the

verbal performance demands of the tests.

There is some consistency from JH to SH in the relative levels of student performance on the divergent thinking ability tests. But the correlations are low enough to admit of much shifting or change in relative levels of the abilities among the students. Of course, the reliability reported for the tests is below that normally reported for tests of convergent abilities, and this also tends to reduce the correlations in addition to changes in the students.

Taylor and Holland (1964) complained that most studies of divergent thinking have relied on tests rather than performance criteria. This study included three independent creativity criteria: peer-, teacher-, and self-assessment of creativity. All three when assessed in SH are correlated with spontaneous flexibility assessed in JH but not with the other two divergent abilities. These results suggest that spontaneous flexibility is a cognitive ability which influences behavior in ways which are visible to teachers, peers, and the student himself and influence the view of the observer when he must nominate or evaluate.

SCAT verbal and quantitative scores assessed in JH are correlated with the divergent thinking abilities of originality and flexibility assessed in SH but not with fluency. Wallach and Kogan (1965) reviewed studies of the relationship between divergent and convergent abilities and concluded that the correlations average about .30. The four significant correlations between SCAT

and originality and flexibility were in the range of .29 to .40 and hence are consistent in identifying approximately the same amount of overlap in the abilities.

SCAT and STEP assessed in JH are also correlated with SH peer and teacher nominations of creativity. This suggests that both teachers and fellow students tend to see some creativity reflected in convergent functioning as reflected in general mental ability and achievement in course work. Conversely, since SCAT and STEP were correlated with flexibility as reported in the 1962 study (Feldhusen, Donny and Condon, 1965), the resulting conclusion may be that SCAT, STEP, and flexibility overlap considerably in what they measure and that either may substitute for the other in a correlation with peer and teacher nominations.

Table 1

Multiple Correlations of Predictor Variables Assessed in Junior High School
with Criteria Creativity Variables Assessed Four Years Later in Senior
High School

Criteria Assessed in 1966	Shrunken R for Best Set of 2 to 6 Predictors			Standard Error			Significant Variables		
	ALL	Boys	Girls	All	Boys	Girls	All	Boys	Girls
1) CR Factor I	.25	.30	.45	3.4	3.7	2.8	12,13,14	1,12,14	1,2,4,6
2) CR Factor II	.33	.31	.51	3.7	3.3	3.6	1,2,12	3,14,18	2,3,12,16
3) CR Factor III	.39	.25	.48	3.0	3.0	2.9	3,10,17	3,8,14,17	7,15
4) CR Factor IV	.37	.32	.42	1.8	1.7	1.7	4,7,11	7,11	4,10,16
5) CR Total	.22	.21	.48	7.5	7.8	6.2	6,11	11,18	4,6,15
6) CR Fluency	.20	.14*	.32	1.7	1.8	1.6	7,11	3,11	7,12
7) CR Flexibility	.36	.33	.51	2.7	2.6	2.5	7,10,17	8,14,17	4,5,10
8) Originality	.55	.51	.52	4.1	4.2	4.1	4,8,10,15,17	1,4,8,10	7,8,15,17
9) Fluency	.37	.36	.52	16.1	17.0	13.2	1,9,10	9,10	6,9,18
10) Flexibility	.58	.62	.67	6.4	6.4	5.3	6,10,12	10,12,18	6,10,15
11) Peer Nomination	.53	.53	.57	1.4	1.4	1.5	1,5,7,10, 15,16	1,4,5,13,16	1,10,15
12) Teacher Nomination	.58	.61	.66	2.2	2.1	2.2	1,5,12,15	1,5,9,14,16	1,10,12,15

Names & Identification Numbers of Predictor Variables

- | | | |
|----------------------------------|-------------------|-----------------------|
| 1) CR Factor I (Conformity) | 7) CR Flex. Items | 13) STEP Math |
| 2) CR Factor II (Non-Conformity) | 8) Originality | 14) STEP Science |
| 3) CR Factor III (Energy) | 9) Idea. Fluency | 15) STEP Soc. Studies |
| 4) CR Factor IV (Diffidence) | 10) Flexibility | 16) STEP Reading |
| 5) CR Total Checks | 11) SCAT Verbal | 17) General Anxiety |
| 6) CR Idea. Fluency | 12) SCAT Quant. | 18) I-Scale |

* This is the only multiple R in this table which is not significant at least at the .05 level.

Correlations of Variables Assessed in Senior High School with Criteria Measures Assessed Four Years Earlier in Junior High School for All Students, Boys, and Girls

Variables Assessed in Junior High School 1962

Criteria Assessed in 1966	Variables Assessed in Junior High School 1962																		
	CR Fac 1	CR Fac 2	CR Fac 3	CR Fac 4	CR Total	CR Fluency	CR Flex 7	CR Orig 8	CR Fluency 9	CR Flex 10	CR Verb 11	CR Quant 12	CR Math 13	CR Sci 14	CR S.S. 15	CR Read 16	CR Gen Anx 17	CR Scale 18	CR Means
1) CR Factor I	.25*	-.06	.07	.22	.12	.17	.20	.12	.06	.16	.22	.19	.10	.24	.18	.23	.01	-.01	18.79
	.21	-.04	.06	.18	.07	.08	.17	.20	.04	.17	.23	.23	.08	.25	.19	.25	-.15	.02	18.41
	.29	-.09	.14	.30	.17	.33	.28	.08	.11	.19	.26	.15	.18	.26	.19	.18	.04	-.05	19.24
2) CR Factor II	-.15	.26	-.04	.01	.04	.02	-.01	.06	.04	.01	.05	-.12	.07	-.05	.05	.07	-.02	.01	10.40
	-.22	.13	-.23	-.16	-.09	-.09	-.18	-.09	.00	-.11	.03	-.11	.01	-.16	-.11	.00	.06	.23	10.93
	-.02	.40	.08	.18	.20	.13	.14	.15	.09	.12	.02	-.15	.10	.03	.18	.16	.06	-.24	9.74
3) CR Factor III	.19	.08	.32	.15	.23	.20	.26	.10	.01	.21	.11	.00	.08	.12	.05	.00	-.16	.08	13.17
	.13	.00	.23	-.01	.11	.04	.06	.21	-.05	.18	.08	.01	.05	.10	-.04	.04	-.12	.08	13.77
	.35	.19	.36	.33	.41	.38	.47	.04	.07	.22	.08	-.03	.07	.11	.12	.01	-.02	.05	12.44
4) CR Factor IV	.14	.08	.10	.27	.15	.13	.24	.11	.07	.22	.31	.20	.25	.20	.21	.20	-.18	-.07	4.99
	.08	.03	-.03	.16	.02	-.04	.17	.16	.03	.18	.32	.23	.23	.27	.27	.27	-.15	-.11	5.35
	.30	.15	.17	.40	.32	.32	.31	.09	.10	.24	.25	.14	.24	.07	.12	.19	-.04	-.06	4.56
5) CR Total	.12	.14	.12	.15	.17	.19	.19	.11	.07	.15	.18	.01	.11	.14	.12	.15	-.06	.03	45.43
	.04	.05	-.01	-.01	.03	.02	.03	.10	.01	.06	.15	.03	.05	.09	.01	.12	-.09	.19	46.16
	.28	.27	.23	.39	.27	.42	.41	.13	.16	.26	.19	-.03	.17	.19	.28	.23	.08	-.20	44.55
6) CR Fluency	-.00	.05	.05	.03	.05	.09	.14	-.06	.04	.08	.08	-.03	.05	.08	.06	.04	-.07	-.01	8.05
	-.03	.01	-.12	-.10	-.04	.02	.01	-.01	-.05	.01	.11	.03	.05	.09	.04	.09	.02	.09	8.29
	.10	.12	.18	.20	.18	.18	.29	-.10	.18	.15	-.01	-.14	.01	.02	.06	.02	.01	-.18	7.76
7) CR Flexibility	.19	.02	.16	.22	.18	.20	.29	.13	.09	.26	.22	.14	.22	.23	.17	.14	-.17	-.03	12.92
	.09	-.05	.02	.03	.01	.05	.13	.24	.01	.20	.21	.15	.21	.26	.14	.15	-.23	-.01	13.31
	.39	.12	.26	.46	.39	.37	.45	.07	.19	.31	.20	.12	.20	.16	.19	.16	-.01	-.07	12.43
8) Originality	.16	-.03	.01	.28	.04	.20	.25	.30	.14	.37	.37	.29	.32	.37	.41	.28	-.24	-.00	8.82
	.22	-.09	-.07	.28	.03	.13	.22	.37	.14	.42	.37	.34	.30	.37	.38	.33	-.19	-.08	9.62
	.16	.01	.05	.31	.07	.28	.28	.28	.14	.30	.36	.23	.33	.35	.47	.30	-.13	.05	7.84
9) Fluency	.09	.03	.01	.10	.03	.18	.05	.08	.37	.16	-.02	.00	.00	.05	.04	.09	.05	.00	53.74
	.04	-.04	-.02	.07	-.03	.09	-.07	.10	.37	.14	-.05	.01	-.03	.05	.01	.07	.05	-.12	51.59
	.23	.01	.16	.24	.11	.36	.31	.06	.41	.30	.14	.04	.11	.15	.20	.10	.00	.16	56.37
10) Flexibility	.16	.11	.02	.22	.13	.27	.22	.13	.12	.56	.38	.32	.37	.42	.39	.35	-.11	-.10	19.91
	.10	.01	-.00	.20	.03	.15	.08	.23	.09	.58	.37	.40	.35	.40	.33	.32	-.08	-.24	20.22
	.33	.19	.06	.29	.27	.45	.42	.06	.17	.59	.45	.23	.41	.48	.53	.43	-.07	.05	19.55
11) Peer Nomination	.32	-.09	.06	.25	.12	.15	.32	.01	.04	.34	.39	.29	.39	.38	.45	.43	-.11	-.05	2.50
	.31	-.15	.09	.31	.10	.07	.26	.03	-.05	.23	.41	.35	.40	.37	.43	.44	-.23	-.11	2.55
	.34	-.03	.02	.18	.14	.23	.38	-.00	.17	.47	.38	.24	.38	.40	.48	.44	-.00	.02	2.44
12) Teacher Nomination	.31	-.05	-.04	.25	.10	.16	.28	.04	.04	.33	.47	.42	.44	.47	.53	.51	.00	-.13	1.96
	.33	-.13	.03	.23	.11	.08	.26	.11	-.12	.18	.52	.43	.39	.52	.52	.51	-.21	-.15	1.74
	.29	.03	-.07	.28	.08	.26	.33	.00	.08	.54	.47	.42	.53	.45	.57	.49	.08	-.10	2.23

Predictor Variables from 1962 (Junior High School)

- 1) CR Factor I (Conformity)
- 2) CR Factor II (Non-Conformity)
- 3) CR Factor III (Energy)
- 4) CR Factor IV (Diffidence)
- 5) CR Total Checks
- 6) CR Idea. Fluency
- 7) CR Flex. Items
- 8) Originality
- 9) Idea. Fluency
- 10) Flexibility
- 11) SCAT Verbal
- 12) SCAT Quant.
- 13) STEP Math
- 14) STEP Science
- 15) STEP Soc. Studies
- 16) STEP Reading
- 17) General Anxiety
- 18) I-Scale

* The top number is the correlation for all Ss, the middle is for boys, the bottom for girls. The following are the minimum levels for r for significance at the .05 and .01 levels for all Ss, for boys and for girls: All Ss, .13 and .17; boys, .18 and .24; girls, .20 and .26.

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Appendix A

Wallach and Kogan (1965) argued that creativity test scores are correlated with intelligence because creativity tests are often given under conditions which are similar to the conditions of intelligence testing, namely the test pressure and the time pressure. They found that when creativity tests are given under free and playful conditions, which they argued would be similar to real creative productions, none of the correlations with intelligence were significant.

The free and playful atmosphere for creativity testing seemed inappropriate to the present researchers. We felt that, contrary to the note of caution given in the manuals of most creativity tests, students should be encouraged to be creative and should be given examples of creative responses. In short, we thought that in practical situations requiring creative solutions to problems, people try to be creative and the creativity test should establish the same set.

Accordingly one group of 100 students was given the divergent thinking tests with directions to be creative and with examples of creative responses. The following directions were used for the Consequences Test:

Consequences

"We want to see how creative you can be. The "Consequences" test can be fun to take. Here are the rules:

1. List many ideas -- the more you list the more creative you are.
2. Make each idea different from the others.
"For example: if I were to ask you, 'What would happen if we could no longer walk across streets in Plymouth?'"
 1. traffic deaths would be reduced
 2. circus cannons could be used to shoot people across
 3. short airplane ride business would boom
 4. elevate all the roads and walks under them

Appendix A (contd)

A sample of 100 Ss was drawn from the group who took the divergent tests with the standard directions which did not mention creativity and which emphasized time limits and amount of production. Performance of the two groups was then compared, and it was found that there were no significant differences between the means for ideational fluency, originality, and spontaneous flexibility.