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INTELLECTUAL AND CREATIVITY TEST FACTORS IN HIGH SCHOOL

JAIME BULATAO, S.J. AND ISABEL REYES-JUAN
Ateneo de Manila University

The administrative order of the Bureau of Public Schools requiring each school in the Philippines to set up a guidance and counseling program has resulted in a sudden increase in the number of psychological tests given all over the country. In the first enthusiasm for testing, everyone reached out for existing tests, most of which were made in the United States and standardized for an American population.

Early results immediately showed an obvious need to adapt such tests to a Philippine situation. Such adaptations followed two lines. First, there was an attempt to re-standardize the tests on a Filipino population, a line followed by many of the studies in the book on guidance by Ordoñez (1960). Thus, typically, the 100 score on an I.Q. test was lowered to fit the mean of the sample being measured.

The second line of adaptation was to change some of the original items, substituting Filipino objects for American ones, e.g. bananas for pears, typhoons for hurricanes, etc. Such attempts were made, for instance, by the Bureau of Public Schools as well as by the Philippine Psychological Corporation.

Aside from these adaptations, there have been attempts to create purely Filipino tests in English, such as the self-administering mental ability test of Padilla, the college aptitude examination of Limcaco and the AHSMAT of Bulatao. It was in the process of creating these instruments that a new problem came up: What is being measured by the psychometric tests, whether American or Filipino, commonly given in the Philippine schools?

This problem arises because up to now, it has been assumed that a test which in the U.S. measures intelligence likewise measures intelligence in the Philippines, one measuring numerical ability in the U.S. likewise measures numerical ability in the Philippines, etc. There is even a second assumption in such thinking, namely, that the organization of abilities in the Filipino is the same as that in the American, i.e., that the pattern of intelligence is the same, and that differences are merely in the matter of more or less in these abilities. These are the assumptions which only now are being challenged.

Thus, the Filipino test constructor, at the present stage of the development of psychometrics in the Philippines, is faced with the problem: What in the Filipino mind are we measuring with our tests? What categories of abilities do our tests tap?

One key to the solution of such questions is factor analysis (Thurstone, 1947). By this mathematical technique one can tease out the various factors being tapped by diverse tests and specify what these tests are measuring. It is specially useful in the exploratory stage of test construction when the "buckshot" approach is forced upon the test constructor, simply because he has little or no previous data to go on.

The factor analytic technique was first used on Filipino subjects by Guthrie (1963) whose primary purpose was to study the organization of their abilities. He used a large number of short tests, devised for the experiment, rather than standard ones, and confined his subjects to females.

The present study differs from Guthrie's in that it is more of an attempt to study existing tests, many of which are commonly given in Philippine schools, to see what factors they tap in a particular Filipino situation. The tests were limited to intellectual factors (except for two variables, cf. below), including tests of creativity which are now beginning to be used side by side with the traditional intelligence and achievement tests. The question asked is: What are these tests measuring?

PROCEDURE

Tests

The tests used in this study were the ones routinely given as part of an admission, orientation, placement, and vocational selection program in a high school in Quezon City. In addition to the standard tests which measured intelligence and achievement factors, there was included an experimental battery of creativity tests which were in the process of construction, with the precise view of adding them to the screening battery. Actual school marks ,i.e., the semestral averages, were also included in the factor analysis to provide an external "validation" for the tests as well as to answer the supplementary question as to what abilities were being rewarded or retarded by the school system of marking.

Here follows a description of the variables used in the factor analysis:

1. *Verbal Reasoning.* From the Differential Aptitude Tests, Form A.

2. *Numerical Ability.* From the Differential Aptitude Tests, Form A.

3. *Abstract Reasoning.* From the Differential Aptitude Tests, Form A.

4. *Clerical Speed and Accuracy.* From the Differential Aptitude Tests, Form A.

5. *Mechanical Reasoning.* From the Differential Aptitude Tests, Form A.

6. *Space Relations.* From the Differential Aptitude Tests, Form A.

7. *Spelling.* From the Differential Aptitude Tests, Form A.

8. *Grammar.* From the Differential Aptitude Tests, Form A.

9. *Necker Cube.* The subject was asked to look at a drawing of a Necker Cube (Woodworth & Schlosberg, 1954, p. 410), for two minutes, with a 10-second rest in between. The score consisted of the number of times he saw the cube reverse itself.

10. *Uses for Things.* A list of six common objects, e.g. toothpick, paper clip, etc., was presented to S who wa sasked to write down as many uses for them as he could think of. The total score on this test is the number of times a change in type of use in made. This is referred to as spontaneous flexibility by Guilford (1962). Time limit: 10 minutes.

11. *Components Test.* From the Flanagan Aptitude Classification Tests, From A (Flanagan, 1953). The task was to identify a simple figure that is part of a complex drawing. This is similar to the Embedded Figures Test of Gottschaldt and to Cattell's (1956) Hidden Shapes which was used on the Getzels-Jackson (1962) study as a test of creativity.

12. *Seatmate.* The sociometric device was originally included in the hypothesis that it would turn out as a test of creativity. The subjects were asked to name five classmates whom they would like to have as possible seatmates in class.

13. *I.Q.* This was the total IQ given by the California Mental Maturity Test which all the subjects had taken two and a half years before as part of the regular school testing program.

14. *Age.* Chronological age.

15. *Achievement.* This was the weighted average school marks for the first semester in third year high school. Weights for the different sections (honors, semi-honors, and non-honors) were empirically derived from the performance of previous classes on standard achievement tests.

16. *Remote Associations Test (RAT).* A list of 24 sets of three words each. The task was to find a fourth word which was associated with each of the three other words in the set. For example: Problem: tree, dog, meow; Answer: bark. This test was adapted by the Ateneo Central Guidance from the Remote Associations Test developed by Mednick (1962).

17. *Metropolitan Reading Test.*

18. *Arithmetic Fundamentals.* Subscore from the Metropolitan Arithmetic Test.

19. *Arithmetic Problems.* Subscore from the Metropolitan Arithmetic Test.

TABLE 1

CORRELATIONS AMONG 22 PSYCHOLOGICAL VARIABLES*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Verbal Reasoning																					
Numerical Ability	306																				
Abstract Reasoning	423	222																			
Clerical Speed & Accuracy	136	039	227																		
Mechanical Reasoning	468	155	400	171																	
Space Relations	506	134	448	192	522																
Spelling	462	160	247	156	212	197															
Grammar	750	310	427	212	457	439	556														
Cube	226	157	198	200	387	330	154	232													
Uses for Things	340	009	233	297	212	224	183	345	246												
Components	408	106	305	238	472	524	124	346	216	233											
Seatmate	066	138	015	—012	052	014	084	—029	087	—067	—135										
I.Q.	618	266	388	327	367	475	387	625	254	427	454	—043									
Age	—097	—015	—099	—055	016	—133	—103	—131	—021	—061	—079	—058	—253								
Achievement	635	363	386	347	350	390	479	757	215	389	308	160	575	—215							
RAT	421	206	246	078	364	320	257	406	155	158	296	—012	323	—028	316						
Reading	662	252	350	321	335	314	476	664	297	320	279	003	636	—014	611	325					
Arithmetic Fundamentals	379	348	352	286	290	232	176	516	252	189	265	—045	369	234	483	182	486				
Arithmetic Problems	522	447	361	272	409	366	228	563	287	295	402	010	459	158	563	287	536	731			
Years in this school	—053	106	—060	231	—037	—035	—077	092	265	—015	026	141	069	171	104	—042	089	269	276		
AHSMAT	686	380	496	139	439	470	424	683	226	246	352	010	592	—084	648	375	616	417	552	000	
Progressive Matrices	479	341	520	511	373	517	476	549	218	248	340	025	423	—155	573	323	339	434	507	089	519

20. *Years in this school.* This variable was was included to study its effect upon achievement and creativity.

21. *AHSMAT.* This was an intelligence test of the Otis type, constructed with a Filipino population in view. This purpose guided the choice of items, vocabulary, and style. Item analysis was done on a Filipino sample from the Manila public schools. The score used for the factor analysis was the raw score, unmodified by considerations of chronological age.

22. *Raven's Progressive Matrices.*

In addition to the variables listed above, two other tests were originally given but were dropped from the factor analysis. These were:

23. *Muller-Lyer Illusion.* A technique was developed which yielded a reliable measure of this illusion. It was dropped from the analysis due to its failure to correlate with other measurs.

24. *Controlled Necker Cube.* This second score on the Necker Cube in response to instrutions to "let the cube shift as little as possible" likewise failed to correlate with the other measures.

Subjects

The subjects were 234 boys in their first semester of third year high school. Their mean age was 15 years and 2 months, with a standard deviation of 8.49 months. The oldest was 18 years, 4 months and the youngest was 13 years, 5 months. Most belonged to upper or upper middle-class families. The average intelligence, as measured on the California Mental Maturity Test, was 106,42, with a standard deviation of 9.68.

Analysis

Obtained data were punched in IBM cards, and the matrix of intercorrelations was obtained by IBM computer. The factor analysis itself was a class project of a class in factor analysis. The Thurstone Centroid Method was used. The communalities were obtained by factoring the original correlation matrix using the highest correlation coefficient in each column and adjusting the diagonal cells after each factor. From the resulting factor matrix, the communalities were obtained and inserted in the original correlation matrix. This matrix was again factored to obtain the final factors. Axes were then rotated to simple structure by the oblique method.

RESULTS

The initial matrix of intercorrelations is given in Table 1. The table, as might be expected with a table of intellectual factors, shows a large number of highly correlated variables at the very start. It may be noted that age shows a low, negative but significant correlation with IQ (as well as Progressive Matrices). This correlation must be undertood as an artifact of the testing situation where some repeaters are included, who naturally tend to be duller and older than their classmates. Likewise the fact that "years in this school" correlates slightly and positively with age but not with IQ (or with Progressive Matrices) may reflect admission policies setting minimum age limits for admssion to this school's kindergarten.

The process of extracting the factors was then started. The final factor matrix is given in Table 2. The original communalities referred to in this table were the ones inserted in the original correlation matrix to obtain the final factor loadings. The final factor loadings yielded a new set of communalities called calculated communalities in the table. A comparison of the calculated and original communalities for each variable showed that the factorization was quite adequate. The total calculated communality accounted for 100.11% of the original communality, indicating a very slight overfactorization. The stage to which factorization should be carried was also evident in the actual process of calculation, for after each factor was obtained, the cumulative contribution of the factor could be compared with the total original communality. Thus, in Table 2, the first factor accounted for 7.504 or 63.89% of the communality. The McNemar test of significance was also applied to the last factor residual matrix. This definitely showed that the process of factorization was adequate.

A close inspection of the table reveals one very strong factor. This factor will be interpreted after the rotations.

TABLE 2

CENTROID PATTERN FOR 22 PSYCHOLOGICAL VARIABLES

	Common-factor coefficients*						Communality	
Variables	I	II	III	IV	V	VI	Original	Calculated
1	782	100	— 274	209	— 028	— 075	763	747
2	401	263	133	067	— 195	— 052	311	293
3	564	— 164	042	136	— 148	180	429	420
4	408	— 209	177	— 454	159	262	473	542
5	581	— 252	119	273	011	— 115	526	503
6	615	— 399	061	197	— 097	— 114	603	602
7	496	117	— 307	— 128	— 139	126	433	406
8	828	191	— 266	075	025	042	808	801
9	416	— 108	213	— 130	122	— 263	320	331
10	412	— 170	— 156	— 138	255	110	323	319
11	516	— 361	060	242	165	— 095	498	495
12	069	183	120	— 204	— 311	— 271	238	264
13	753	— 100	— 261	— 054	163	— 101	705	685
14	— 108	242	332	187	260	112	312	296
15	811	201	— 161	— 155	— 094	052	781	760
16	444	— 042	— 079	198	— 037	— 068	264	250
17	275	225	— 221	— 032	226	007	694	677
18	596	315	367	110	261	257	705	735
19	736	272	347	137	155	028	774	780
20	135	197	414	— 291	213	— 129	343	375
21	760	128	— 151	211	— 115	016	682	675
22	731	— 145	156	— 081	— 337	321	761	806
Total							11.746	11.762
Contribution of factor	7.504	1.038	1.129	.818	.739	.534		
Per cent of total original communality	63.89%	8.84%	9.62%	6.92%	6.29%	4.55%	100%	100.11%

* Decimal points have been omitted.

Eight rotations were then made. It was concluded that there was no striking indication of further rotation at this point. The rotated factor matrix appears in Table 3.

Intercorrelations of the reference vectors are shown in Table 4.

With the exception of the slight correlation between vectors II and V, the others are small enough to warrant

TABLE 3

LOADINGS ON THE FINAL ROTATED FACTORS*

	I	II	III	IV	V	VI
1. Verbal Reasoning	587	087	—049	028	300	265
2. Numerical Ability	296	—225	236	—008	227	140
3. Abstract Reasoning	156	138	183	069	360	—001
4. Clerical Speed and Accuracy	030	363	348	569	026	—014
5. Mechanical Reasoning	053	306	248	—044	236	290
6. Space Relationship	—018	345	206	074	388	306
7. Spelling	477	—054	—128	261	303	012
8. Grammar	690	076	—007	146	244	186
9. Cube	023	258	345	246	032	429
10. Uses for Things	210	393	000	289	—026	072
11. Components	—007	473	181	—009	111	273
12. Seatmate	037	—316	151	169	240	263
13. I.Q.	447	359	—009	303	168	346
14. Age	004	—024	274	—284	—374	—130
15. Achievement	626	—008	112	348	329	194
16. RAT	222	100	032	—042	204	176
17. Reading	662	169	027	202	015	218
18. Arithmetic Fundamentals	416	092	531	—027	—159	—033
19. Arithmetic Problems	427	081	545	000	—003	213
20 Years in this school	025	048	481	236	—248	234
21. AHSMAT	537	003	058	007	348	172
22. Progressive Matrices	194	042	361	310	566	—063

* Decimal points have been omitted.

TABLE 4

CORRELATIONS OF REFERENCE VECTORS

	I	II	III	IV	V	VI
I	1.000					
II	—.276	1.000				
III	—.269	.080	1.000			
IV	.031	.234	.130	1.000		
V	—.056	—.356	—.062	1.000		
VI	.019	.196	.184	.212	.034	1.000

saying that the factors obtained are independent of each other.

Identification of the Factors

Factor I seems to be *English Proficiency*. The high loadings on Grammar, Reading, and even Spelling indicate the presence of a factor other than pure Verbal Reasoning, even though the latter test, too, loads heavily on it. Most likely, the factor is an undifferentiated combination of an ability to use English, an ability to manipulate verbalized concepts, as well as a familiarity with Western culture. The ones in our culture (or at least in this particular school) who can "think" in verbal concepts are likewise the ones who have acquired such concepts through English.

It is noteworthy that "Arithmetic" tests load heavily on this factor. The vehicle of English through which Arith-

metic was taught and in which the test is given may have much to do with this "contamination." The high loading of Achievement, school marks, would show how much English proficiency is rewarded in this educational setup.

An inspection of the loadings shows that this English Proficiency Factor is the strong factor discovered in Table 2. It is the most important among those extracted in this factor analysis.

Factor II seems to be a sort of "*Creativity Factor*". By this term and in this situation is meant an independence of thinking, an efficiency, alertness, ego-strength, or similar traits. The test most heavily loaded on this factor is the Components Test, which requires the ability to perceive a form independently of distracting detail. Likewise, the Uses for Things test requires an agile mind and an imagination untrammeled by convention. The Clerical Speed test may reflect the alertness and drive of such an individual. An interesting fact is that "Seatmate" loads negatively on this factor, as if to say that people who are independent and nonconformist are not going to be sought after as seatmates by their peers.

Factor III is clearly *Numerical Ability*, with emphasis on problem-solving. All the arithmetic tests are loaded with this factor, although for some reason the DAT Numerical Ability subtest is much lower than the Metropolitan Arithmetic Tests and is even slightly lower than the Necker Cube (which now presents possibilities of validity for predicting numerical ability, in spite of its simplicity and ease of administration). Why should "years in this school" be filled with the numerical ability factor? One hypothesis may be that those who received their early grade school training in this same school were thoroughly drilled in numbers. A less likely hypothesis is that those with numerical ability (as opposed to those with verba English proficiency) tend to repeat th year.

Factor IV seems to be a *Cleric Accuracy and Speed Factor*. This lab must be understood as something mo than the ability to copy clerical detai accurately and rapidly as usually unde stood. It seems to involve a motiva tional element to apply oneself to task, a competitive spirit and a re ponse to a challenge. These are th elements involved in the actual takin of the DAT Clerical Speed and Accurac subtest, which were observable in th subjects taking the test. There wer some who took the test as a challeng others merely as a task. Hence th term "clerical accuracy and speed" mus be seen as embracing an attitudina element in its composition, forcing th mind to face a challenge. Such a trai would go a long way towards obtainin good marks, as reflected by the secon highest loading on this factor, which i that of school Achievement. Raven' Progressive Matrices likewise require an intense degree of accurate seeing o similarities and differences in designs

Why should age load negatively o this factor? Most likely it is becaus the older ones are precisely the one lacking the drive and the need to b accurate and precise. They are slowe than their nimble peers who at a younge age have reached the same year in high school as they. A hypothesis tha clerical accuracy and speed decline beginning at about age 14 years is hard ly tenable.

Factor V is the *Spatial Reasoning Factor*, the ability to envision a problem in space and solve it there. Raven's Progressive Matrices presents the bes representative for this factor. Nex come the DAT Spatial Reasoning and the DAT Abstract Reasoning subtests The AHSMAT, the test constructed as

a screening device for this school, contains a large number of problems which need to be visualized in space for their solution. Even Spelling can be said to need such visualization.

Why should age and years in this school load negatively on this factor? Again it is quite possible that those who are slower at learning and have to repeat a year every now and then fail precisely for lack of this ability.

Factor VI is difficult to interpret and it may be safer to leave it unnamed. One may, however, hazard a guess and call it the *Obsessive-Compulsive Factor.* The reason for so naming it is based in great part on Eysenck's (1957) experimentation on the Necker Cube, the fluctuations of which seem to have something to do with the hysteric-dysthymic dimension. It can be seen how a compulsive personality will try his best to obtain as many cube reversals as possible within the given time. To explain the loading of the IQ on this factor, one has to call to mind the clinical cliché that obsessive-compulsives tend to be brighter than average. Likewise, the DAT Spatial Reasoning Test, as may be attested by those who have given it in the Philippines, demands much "stick-to-it-iveness," which may well be the obsessive-compulsive trait.

Comparison with Guthrie's Factor Analysis

The factors obtained in this analysis can fit with Guthrie's (1963) factor analysis, for although the latter used only women subjects and had a different purpose, similarity of culture may allow a limited comparison of the two. The comparison, of course, remains tentative.

Factor I seems the same as Guthrie's Factor II, *Verbal Comprehension.* It is of interest that Spelling finds a place in both these factors, even though Guthrie in addition found still another Spelling Factor, his Factor XI. Guthrie likewise found that school achievement marks loaded higher on his Verbal Comprehension factor than on any other.

Factor II has something in common with but is not quite the same as Guthrie's Factor VIII, *Ideational Fluency.* The Components Test, which loads heaviest on our *Creativity Factor,* is hardly a measure of *Ideational Fluency.* The same holds for Mechanical Reasoning and Space Relations. Of course, Uses for Things does have something in common with Guthrie's Topics, Topics in Tagalog, Thing Categories, Thing Categories in Tagalog. But as a whole, Factor II does not seem to have its counterpart in Guthrie's factor analysis.

Factor III is similar to Guthrie's Factor I, *Numerical Facility,* except that the problem-solving element enters more into the picture. It is not merely operations in simple arithmetic.

Factor IV may be Guthrie's Factor XV, which however seems to be more than "facility or confidence in handling digits." There may likewise be in Guthrie's factor a motivational element, forcing the mind to apply itself with accuracy and speed.

Factor V seems to be Guthrie's Factor IV, *Visualization,* which also contains a reasoning element.

Factor VI, being difficult to interpret, also has difficulty in finding counterparts.

DISCUSSION

The factor analysis brings out many interesting facts regarding the strange ways in which tests act in a culture other than their own home culture. It also suggests better tests for predictive batteries.

1. The overwhelming proportion of variance taken out by the *English Proficiency Factor* is very indicative of the importance that a foreign language, when used as a medium of instruction, has in a testing program. Tests which one believed to be measuring intellectual traits like arithmetic proficiency, verbal reasoning, etc. turn out to be in great part measuring only the language in which these tests are couched. This phenomenon is known in psychometric literature as "contamination" since the contaminated test is measuring other factors than what it was meant in the abstract to measure.

The consequences of this principle with regard to American tests used in the Philippines are important to note. Filipinos are handicapped whenever English is used as a vehicle for any test precisely because it is bound to measure English proficiency besides whatever else it is meant to measure. A good illustration of this point is an experiment at the Ateneo Language Center where the Carroll Modern Language Aptitude Test (MLA) was used to try to predict ability to learn a foreign language. The test had taped instructions in English and a simulated modern language, the test of which was read by an American. While the test successfully predicted language learning ability in the American group, it failed to do so for the Filipino group. From the present factor analysis, one can see that with the Filipino group the MLA was measuring not language learning ability but the ability to work with American concepts and use American language tools.

2. Furthermore an Otis type test, such as the AHSMAT in the present battery, can be predicted to favor girls and be unfair to boys. This unfairness is due to two facts: the high loading of such tests on the *English Proficiency Factor* and the proven superiority of girls in verbal ability. This verbal superiority is specially noticed by teachers in the study of a foreign language such as English, specially in high school. One can thus predict that where a single set of norms is used for boys and girls as in the Otis, the girls are bound to be superior to their male classmates not only in mental age (which is the result of the earlier development of girls) but even in IQ. Such prediction is actually fulfilled, as may be seen in the paper on the evaluation of Educational TV, where girls have an Otis IQ which is 2.36 points higher on an average than boys of their class and age (Bulatao & Vergara, 1965).

This point is very important specially in the screening of boys and girls for college or for scholarships, since girls will tend to beat the boys, by an artifact in the tests. One possible solution, of course, is to have separate norms for boys and girls.

3. More important still for educational theory is the hint here given, that when education is carried out in a foreign language, a man's education, his ability to utilize concepts, his fund of information regarding the world, etc. will depend in a very large part upon his mastery of the educating language. Apparently, concepts are not differentiated unless the educating language is mastered in its nuances of grammar, connotation, and underlying cultural meanings. Where a foreign language cannot be so mastered it may be better for human growth to remain within one's native language and seek differentiation of concepts therein A Jack-of-all-languages and master of none is not only not a master of language but cannot even be a master of other disciplines. Nevertheless, the ideal setup (if such a situation can eixst) is to be master of two or even more

languages, in order that the mind may be differentiated adequately to control two or more cultures.

4. The marking system of our schools may require a re-evaluation. It is notable that Achievement, the pupil's school marks, does not have any loading on *Creativity* and only a light loading on *Numerical Ability*. This fact indicates that in this culture (or subculture), creativity and numerical ability are not being encouraged by the school system. The ones being so encouraged are those who are good in English Language Usage and in Clerical Speed and Accuracy.

5. The Differential Aptitude Test, a favorite among High School Vocational counselors, holds up well to the extent that it has high loadings in most factors. However, interpretation has to be adjusted to the Philippine pattern. Thus, Verbal Reasoning is seen as measuring fundamentally the same factor as Language Usage, Grammar. Numerical Ability turns out to be a relatively poor test in its poor loadings in the *Numerical Ability Factor* and its contamination by the *English Proficiency Factor*. Low negative loadings on creativity suggest that those who do well on the Numerical Ability subtest are not necessarily creative. Perhaps because the Numerical Ability subtest, unlike the Metropolitan Arithmetic Test, provides multiple-choice loading on Factor III. The Metropolitan Arithmetic Test, on the other hand, forces the student to supply the answer positively.

The Clerical Speed and Accuracy subtest assumes in a Philippine background a new dimension which is quite different from the usual "clerical ability" which it is usually thought to measure. As has been said, it may represent a motivational element, a desire to succeed together with a need to be accurate and eaxct. Its loadings on the *Numerical Ability Factor* confirm this element of exactness in it. Since it is independent of English proficiency but nevertheless goes well with Achievement and even with Creativity, it seems a good candidate for inclusion in a screening battery.

6. The analysis seems to have been successful in isolating a creativity factor. Two of the creativity tests, Components and Uses for Things, loaded most heavily on this factor. A third, the Necker Cube, to a certain extent was also loaded with it. Likewise three of the DAT tests, all of them fairly independent from English proficiency, namely Clerical Speed and Accuracy, Mechanical Aptitude, all have some of this factor. We thus now have a fairly good battery with which to tap creativity, a trait which is becoming more and more important in educational research and industry.

SUMMARY

Two hundred thirty-four third year high school boys were given routine intelligence, aptitude and creativity tests. Twenty-two variables were factor analyzed and yielded six factors:

I. English Proficiency

II. Creativity

III. Numerical Ability

IV. Clerical Accuracy and Speed

V. Spatial Reasoning

VI. Unnamed, possibly an Obsessive-Compulsive Factor

The results of the analysis showed the importance being given to English proficiency by American-made tests as well as by teacher-ratings. Characteristics of the Differential Aptitude Tests were analyzed. Creativity tests were confirmed in their factorial validity.

REFERENCES

ALLEN, R. D., BIXLER, H. H., CONNER, W. L., & GRAHAM, F. B. *Metropolitan Achievement Tests: Advanced Battery—Complete: Form R.* New York: World Book Company, 1946.

BENNETT, G. K., SEASHORE, H. G., & WESMAN, A. G. *Differential Aptitude Tests.* New York: The Psychological Corporation, 1952.

CATTELL, R. B. *Objective-analytic test battery.* Illinois: Institute for Personality and Ability Testing, 1956.

CLINE, V. B., RICHARDS, M., & NEEDHAM, W. E. Creativity tests and achievement in high school science. *Journal of Applied Psychology,* 1963, 47, 184-189.

EYSENCK, H. J., GRANGER, G. W., BRENGELMANN, J. C. *Perceptual process and mental illness.* New York: Basic Books, 1957.

EYSENCK, H. J., HOLLAND, H., & TROUTON, D. S. Drugs and personality. IV. The effect of stimulant and depressant drugs on the rate of fluctuation of a reversible perspective figure. *Journal of Mental Science,* 1957, 103, 656-660.

FLANAGAN, J. C. *Flanagan Aptitude Classification Tests, Form A.* Chicago: Science Research Associates. 1963.

GETZELS, J W. & JACKSON, P. W. *Creativity and intelligence: Explorations with gifted children.* New York: John Wiley, 1962.

GOLANN, S. E. Psychological study of creativity. *Psychological Bulletin,* 1963, 60, 548-565.

GUILFORD, J. P. Creativity: its measurement and development. In S. J. Paines and H. F. Harding (Eds.), *A source book of creative thinking.* N. Y. Charles Scribner's Sons, 1962.

GUTHRIE, G. M. Structure of abilities in a non-Western culture. *Journal of Educational Psychology,* 1963, 54, 94-103.

HARMAN, H. *Modern factor analysis.* Chicago: University of Chicago Press, 1960.

MEDNICK, S. The associative basis of the creative process. *Psychological Review,* 1962, 69. 220-232.

ORDOÑEZ, M. A. *Principles and problems of guidance in the Philippines.* Manila: Regina Publications, 1960.

PAINES, S. J. & HARDING, H. F. (Eds.) *A source book for creative thinking.* New York: Charlies Scribner's Sons, 1962.

RAVEN, S. C. *Progressive Matrices.* Cambridge: University Press, 1938.

ROGERS, C. R. Toward a theory of creativity. In H. Anderson (Ed.), *Creativity and its cultivation.* New York: Harper, 1959, 69-82.

SULLIVAN, E. T. CLARK, W. W. & TIEGS E. W. *California Test of Mental Maturity: Intermediate — Short Form.* Los Angeles: California Test Bureau, 1950.

TAYLOR C. W. SMITH W. R., & GHISELIN, B. The creative and other contributions of one sample of research scientistis. In C. W. Taylor and F. Barron (Eds.), *Scientific creativity: Its recognition and development.* New York: John Wiley, 1963, 53-76.

THURSTONE, L. L. *Multiple factor analysis.* Chicago: University of Chicago Press, 1947.

WOODWORTH, R. S. & SCHLOSBERG, H. *Experimental psychology.* New York: Holt, 1954.