

## THE ADDITION OF PERSONALITY MEASURES TO ABILITY MEASURES FOR PREDICTING AND UNDERSTANDING SCHOOL ACHIEVEMENT

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### ABSTRACT

This study attempts to validate the findings of previous research predicting academic achievement from intelligence measures with the addition of objective personality factors. Regression analysis was used to affirm: (a) better predictions can be made utilizing both personality and intelligence measures than either alone; (b) there appears to be a change across time in the importance of each predictor; and (c) different achievement areas are best predicted by unique combinations of personality variables.

### INTRODUCTION

Prior to the 1960's, little success accompanied attempts to link the prediction of achievement with personality variables. Having reviewed these studies Middleton and Guthrie (1959) concluded that "the principal difficulty is probably the heterogeneity of the criterion, the antiquity of the personality measures used and the nonsummative or non-linear predictions (p. 66)."

During the next decade and a half, however, a considerable body of literature developed relating personality factors to academic achievement. Much of the earlier material was reviewed by Warburton (1961; 1962a; 1962b) and some of the more recent work done by Cattell and Butcher (1968). Many of the current studies have continued to duplicate the methodological errors that Middleton and Guthrie warned against in 1958; however, some have taken steps to avoid them. Kahler (1973), Clopton and Neuringer (1973) found significant results in relating personality and achievement; but some of the difficulties they encountered may be accounted for in considering whether a test for pathology deals with appropriate predictor variables. Kahler (1973) had much greater success when using an instrument that dealt with variables contained within the normal personality factor space. This was also true of work completed by Lee (1973) and Watson (1973).

Using variables contained in the normal personality sphere and using objective, factor-analytically derived personality measures emerging from Cattell and Butcher's work (1968), Barton, Dielman, and Cattell (1972) achieve some interesting and significant results. Similar results (King, 1975; Mandryk and Schuerger, 1974) have since repeatedly indicated the importance of personality factors in school achievement and that the addition of these personality measures to ability measures significantly increased the multiple R's obtained when compared to the sole use of ability measures.

The intention of this study was to validate the previously reported successful results in the study by Barton, Dielman, and Cattell (1972). The same hypotheses

were tested, namely, "(a) by using a combination of intelligence and personality variables to predict school achievement, better predictions would be obtained than when intelligence variables were used alone; and (b) achievement in different subject areas will be predicted best by a set of personality and intelligence variables unique to each area (pp. 398-399)."

## METHOD

### SUBJECTS

The subjects in the 1972 study were 169 sixth grade students and 142 seventh grade students. The subjects in the present study were 164 ninth grade students enrolled in a parochial school in a Mid-Western, industrial city. All Ss were male, and the socio-economic status ranged from upper-middle class to lower class in approximately equal proportions. In addition, all Ss were from an urban environment.

Table 1

### Personality Factors Measured by the High School Personality Questionnaire

Low-score description	Alphabetic designation of factor	High-score description
Reserved	A	Warmhearted
Low intelligence	B	High intelligence
Emotionally unstable	C	Emotionally stable
Undemonstrative	D	Excitability
Submissive	E	Dominance
Desurgency	F	Surgency
Weak superego	G	Strong superego
Shy	H	Socially bold
Toughminded	I	Tenderminded
Zestful	J	Reflective
Self-assured	O	Apprehensive
Group dependency	Q <sub>2</sub>	Self-sufficiency
Uncontrolled	Q <sub>3</sub>	Controlled
Relaxed	Q <sub>4</sub>	Tense

Table 2  
List of Variables

	Mean	S.D.
Freshman Grade Point Average on 4-point scale (N=147)	2.44	1.06
Sophomore Grade Point Average on 4-point scale (N=128)	2.45	9.62
CAT Reading Comprehension (N=140)	55.6	24.4
NEDT English Usage (N=120)	45.2	27.3
NEDT Mathematics Usage (N=120)	46.1	26.3
NEDT Social Studies (N=120)	59.8	25.2
Average of Forms A and B - CFIQ - IQ (N=164)	30.9	5.3
Average of Forms A and B - HSPQ - Factor A (N=164)	5.4	2.6
Average of Forms A and B - HSPQ - Factor B (N=163)	6.8	1.6
Average of Forms A and B - HSPQ - Factor C (N=163)	5.0	2.7
Average of Forms A and B - HSPQ - Factor D (N=163)	5.5	2.6
Average of Forms A and B - HSPQ - Factor E (N=163)	5.2	1.9
Average of Forms A and B - HSPQ - Factor F (N=163)	5.5	2.6
Average of Forms A and B - HSPQ - Factor G (N=163)	5.5	2.7
Average of Forms A and B - HSPQ - Factor H (N=163)	5.2	2.6
Average of Forms A and B - HSPQ - Factor I (N=163)	3.7	2.6
Average of Forms A and B - HSPQ - Factor J (N=163)	4.3	2.3
Average of Forms A and B - HSPQ - Factor O (N=163)	4.9	2.4
Average of Forms A and B - HSPQ - Factor Q <sub>2</sub> (N=163)	4.2	2.2
Average of Forms A and B - HSPQ - Factor Q <sub>3</sub> (N=163)	4.9	2.1
Average of Forms A and B - HSPQ - Factor Q <sub>4</sub> (N=163)	5.4	2.2

Note:--Abbreviations: CAT = California Achievement Test

NEDT = National Education Development Test

CFIQ = Culture Fair Intelligence Test

HSPQ = High School Personality Questionnaire

MEASURES

As in the 1972 study, all subjects completed both forms (A and B) of the High School Personality Questionnaire (HSPQ) (Cattell & Cattell, 1969) and the *Culture Fair Intelligence Test* (CFIQ) (Cattell & Cattell, 1965). Later in the year standardized achievement tests, *California Achievement Test* (CAT) and *National Education Development Test* (NEDT) were given. Areas covered were in reading, vocabulary and comprehension, English usage, math usage, and social studies. In addition, *Grade Point Averages* (GPA's) were collected for all subjects in their ninth and tenth grade years.

The HSPQ measures 14 dimensions of personality. Forms A and B of the HSPQ were administered on separate days in order to control for diurnal fluctuations. The testing room used was properly equipped with strong lighting, acoustical sound proofing, adequate spacing between seats and proctors. Instructions were carefully gone over at each testing period with the use of a prepared tape recording. A summary table of all the variables with their means and variance are available upon request from the primary author.

Table 3  
Prediction of Achievement from IQ and Personality Measures

Model	Freshman GPA			Sophomore GPA			Social Studies		
	R <sup>2</sup>			R <sup>2</sup>			R <sup>2</sup>		
	Full model	Reduced model	p	Full model	Reduced model	p	Full model	Reduced model	p
1. CFIQ + HSPQ versus CFIQ	.23	.06	<.025	.30	.13	<.01	.41	.21	<.001
2. CFIQ + HSPQ versus CFIQ + B	.23	.09		.30	.18		.41	.28	<.01
3. CFIQ + (HSPQ-B) versus CFIQ	.23	.06	<.01	.29	.13	<.01	.34	.21	<.025
4. CFIQ + B versus CFIQ	.09	.06	<.001	.18	.13	<.001	.28	.21	<.001
5. HSPQ versus 0	.20	0.00	<.01	.24	0.00	<.01	.35	0.00	<.01
6. HSPQ - B versus 0	.18	0.00	<.01	.20	0.00	<.01	.18	0.00	<.01
7. B versus 0	.06	0.00	<.01	.14	0.00	<.01	.01	0.00	
8. CFIQ versus 0	.06	0.00	<.01	.13	0.00	<.01	.21	0.00	<.01

Table 3 (continued)

Model	English Usage			Mathematics			Reading		
	R <sup>2</sup>			R <sup>2</sup>			R <sup>2</sup>		
	Full model	Reduced model	p	Full model	Reduced model	p	Full model	Reduced model	p
1. CFIQ + HSPQ versus CFIQ	.43	.24	<.001	.45	.23	<.001	.42	.30	<.05
2. CFIQ + HSPQ versus CFIQ + B	.43	.34		.45	.30	<.005	.42	.32	
3. CFIQ + (HSPQ-B) versus CFIQ	.36	.24	<.05	.40	.23	<.001	.38	.30	
4. CFIQ + B versus CFIQ	.34	.24	<.001	.30	.23	<.001	.32	.30	<.001
5. HSPQ versus 0	.36	0.00	<.01	.38	0.00	<.01	.28	0.00	<.01
6. HSPQ - B versus 0	.18	0.00	<.01	.24	0.00	<.01	.13	0.00	<.05
7. B versus 0	.12	0.00	<.01	.02	0.00		.17	0.00	<.01
8. CFIQ versus 0	.24	0.00	<.01	.23	0.00	<.01	.30	0.00	<.01

Note:—p.163. Abbreviations: CFIQ = Culture Fair Intelligence Test; HSPQ = High School Personality Questionnaire

PROCEDURE

Tests were computer-scored and correlations were obtained among the personality variables, the ability measure, and the achievement variables. Then, using step-wise multiple-regression analysis, measures of effectiveness were obtained to predict school achievement. These results are shown for GPA and each achievement test in Table 3. The correlations between each of the HSPQ variables and the criterion are shown in Table 4.

Table 4  
Correlations of Personality and Intelligence Variables with Achievement

Variables	Factors														Culture Fair Intelligence Test
	A	B	C	D	E	F	G	H	I	J	O	Q <sub>2</sub>	Q <sub>3</sub>	Q <sub>4</sub>	
Freshman GPA	.03	.25*	.00	.21**	-.13	-.08	.26*	-.09	-.04	-.14	-.03	-.09	-.09	-.08	.26*
Sophomore GPA	.04	.37*	.02	.17***	-.09	-.05	.33*	-.05	-.14	-.19**	-.07	-.05	.08	.03	.36*
Social Studies	.07	.45*	.07	.12	.16***	.13	.21*	.06	-.04	-.13	-.11	.00	-.08	.09	.45*
English Usage	.22**	.50*	.09	.10	.06	.08	.25*	.01	-.03	-.20**	.07	-.07	-.08	.01	.49*
Mathematics	.14	.45*	.09	.18***	.04	-.10	.16***	-.09	-.13	-.14	-.04	.03	-.17***	-.03	.48*
Reading	.10	.42*	.08	.00	.09	.07	.20**	.04	-.06	-.13	-.19**	.00	-.09	-.01	.54*

Note:--Decimals are omitted

N = 163

\* $p < .01$

\*\* $p < .025$

\*\*\* $p < .05$

Eight models were used to test several different hypotheses relating to the predictive efficacy of different intelligence and personality variables in the domain of school achievement. These are the same models as those used by Barton, Dielman, and Cattell (1972).

Model 1 (CFIQ + HSPQ vs. CFIQ) was designed to indicate whether an increase in prediction of achievement was made when the whole HSPQ was added to the CFIQ results.

Model 2 (CFIQ + HSPQ vs. CFIQ + B) indicated whether the addition of just the nonintelligence factors in the HSPQ increased achievement prediction over and above that obtained when both the CFIQ and Factor B were used.

Model 3 (CFIQ + HSPQ-B vs. CFIQ) allowed for the assessment of the non-intelligence factors in the HSPQ over and above the effectiveness of the CFIQ alone.

Model 4 (CFIQ + B vs. CFIQ) showed the effectiveness of adding Factor B to the only other intelligence measure, the CFIQ.

Models 5, 6, 7 and 8 indicated, respectively, the effectiveness in prediction of achievement of the HSPQ along, the HSPQ nonintelligence factors alone, Factor B alone, and the CFIQ alone.

## RESULTS

Several inferences can be made from observing the correlation in Table 4. Factors that were significantly related ( $p < .01$ ) to all the criterion include the two measures of intelligence, Factor B of the HSPQ and the CFIQ. Factor G of the HSPQ, a measure of conscientiousness, was related significantly ( $p < .01$ ) to both freshmen and sophomore GPA's and to English usage achievement. It was also related ( $p < .05$ ) to social studies, math and reading.

Other factors of the HSPQ that were related significantly to the criterion were Factor A, a measure of warmhearted participation, and English usage ( $p < .025$ ). Being excitable or demanding (Factor D) was positively correlated with both freshman GPA ( $p < .025$ ) and sophomore GPA ( $p < .05$ ) as well as mathematics ( $p < .025$ ). Assertiveness (Factor E) was only apparent as contributing to good performance in Social Studies achievement scores ( $p < .05$ ). Factor J (zealful desire for group action) was significantly related to English usage and sophomore GPA ( $p < .025$ ), and Factor O (self-assuredness) was significantly related ( $p < .025$ ) to reading. Factor Q<sub>3</sub> (uncontrolledness) was related ( $p < .05$ ) with mathematics. Correlations between any given personality factor and criterion score were of the same general magnitude and sign over all six areas of achievement (ignoring non-significant correlations).

An examination of the regression analyses results indicated that Model 1, with the addition of the HSPQ to the CFIQ, results for in a significant increase ( $p < .01$ ) in the amount of variance accounted for in mathematics, social studies, English usage, and tenth grade GPA; and ( $p < .05$ ) in reading and ninth grade GPA. In some cases this involved almost a doubling of the variance accounted for by the reduced model. Model 2 indicated that only in mathematics and social studies ( $p < .01$ ) did the addition of the personality variables (nonintelligence variables) of the HSPQ significantly increase the amount of variance accounted for over the addition of just the intelligence factor (B) to the CFIQ. Model 3 indicated that the addition of the HSPQ, without the intelligence factor (B), to the CFIQ significantly increased ( $p < .01$ ) the amount of variance accounted for in mathematics and in ninth and tenth grade GPA's. It also correlated ( $p < .05$ ) in social studies and English usage. In Model 4, the addition of the intelligence factor (B) to the CFIQ resulted in a significant increase ( $p < .001$ ) in prediction for all the criterion measures, GPA's and achievement measures. Ostensibly this appears to be a duplication of intelligence measures, but actually the CFIQ was designed to measure a different form of intelligence (innate or fluid intelligence) than Factor B of the HSPQ (a measure of a more crystalline intelligence influenced by environmental factors).

Model 5 indicated the effectiveness of the HSPQ by itself and Table 4 showed that it was significantly related ( $p < .01$ ) to all areas of achievement. When the intelligence factor (B) was removed and just the personality factors were used to predict achievement, there was still a significant relationship ( $p < .01$ ) for all criterion except with reading ( $p < .05$ ). The predictive power of the two intelligence variables can be determined by examining Models 7 and 8. The CFIQ indicated a significant correlation ( $p < .01$ ) with all measures of achievement, while Factor B of the HSPQ was only related significantly ( $p < .01$ ) to reading, English usage, and sophomore GPA.

Further examination of the regression analyses indicated several conclusions

regarding which combination of predictor variables best predicts achievement in different areas.

**GRADE POINT AVERAGE**

The results indicated that the use of both IQ and personality measures is more accurate in predicting achievement than the use of either measure separately. However, a comparison of Models 1 and 5 showed that the use of the HSPQ alone can predict as effectively as when taken in conjunction with the CFIQ.

**ACHIEVEMENT TESTS**

The results generally were the same as the grade point average in that the use of both the CFIQ and the HSPQ increased the predictive effectiveness beyond that achieved by the use of either of them individually.

Across criterion, the results of this experiment agreed with the results of the previous studies done by Cattell and Butcher (1968), Barton, Dielman, and Cattell (1972) and Cattell, Barton, and Dielman (1972). The amount of variance accounted for by the use of CFIQ and the HSPQ was slightly less, and the number of factors from the HSPQ that achieved a significant correlation was slightly fewer. Generally, the measures of intelligence seemed to account for approximately 20-25% of the variance in achievement scores and the amount of variance almost doubled with the addition of personality measures.

It is of interest to note when the uniform increase in the correlations of the sophomore GPA when compared to the freshman GPA. This runs counter to the expected direction of decreasing correlations with elapsed time as reported in previous research (Humphreys, 1968, 1973).

**Table 5**

**Correlations Predicted with Obtained Test Scores**

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<b>Reading</b>	<b>.54</b>
<b>Mathematics</b>	<b>.48</b>
<b>Science</b>	<b>.44</b>
<b>Social Science</b>	<b>.44</b>

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**CROSS-VALIDATION**

The results reported in the *Handbook for the High School Personality Questionnaire "HSPQ"* (Cattell & Cattell, 1969, p. 50) on a sample of male and female students 14-15 years of age were cross-validated with the results of the present study. Using the author's data, the HSPQ and CFIQ scores (standardized) were multiplied by the weights reported in the Handbook in order to

obtain predicted grades. Then the predicted test scores were correlated with the obtained test scores. The results revealed significant correlations for all achievement criteria (Reading, .54; Mathematics, .48; Science, .44; and Social Science, .44).

### DISCUSSION

The results of the full analyses supported the conclusions drawn by Barton, Dielman, and Cattell (1972). These conclusions related personality to achievement at three grade levels: sixth, seventh and ninth grades. First, a set of three variables (IQ, Factor B and Factor G) were consistently related to academic achievement for this sample. That is, measures of intelligence (fluid and crystallized) and of conscientiousness (Factor G) were significantly and positively related to achievement as measured by high school grades and standardized achievement tests.

Second, there are particular personality variables that are relevant to achievement at different ages or at different developmental stages. Factors such as J and O become important in seventh grade (Barton, Dielman, & Cattell, 1972) but lose some of that importance by ninth grade where they appear only significant to achievement in English. Factor C first appears in seventh grade, but, again, by ninth grade has disappeared as important to achievement.

Third, in ninth grade certain personality variables, in addition to conscientiousness (Factor G), appear important to achievement in certain subject areas and not others. Factor E (assertiveness) indicates a positive effect for success in Social Studies but for no other area. Factor J appears important for achievement in English and sophomore GPA. So, too, self-assuredness (Factor O) appears important for achievement in reading but not so crucial for other subject areas. One unexplained result was that Factor D (excitability) and Factor Q<sub>3</sub> (uncontrolled) were significantly correlated ( $p < .05$ ) with mathematics. This result clashes with the intuitive notion that mathematics requires precision and control; however, if the nature of the criterion measure is kept in mind — a national achievement test — a possible understanding exists in seeing these dimensions in the context of the test taking behavior related to mathematical performance. One other interesting result in this regard is the positive correlation that excitability (Factor D) has with both freshman and sophomore GPA. When considering the context of a parochial school, it would not be unusual to have responsive, excitable qualities favorably rewarded.

### CONCLUSION

Generally, the addition of personality variables to intelligence measures when predicting academic achievement appears to be a valid procedure and seems to significantly increase the overall amount of variance accounted for. For possibly the most meaningful application of this data, the addition of personality information increases the clinical understanding of academic success (failure) and thus enhances the probability of effective remedial and preventive intervention. Although the general nature of these personality characteristics and their relationship to academic achievement seem to be gaining some degree of consistency (King, 1975; Mandryk and Schuerger, 1974),

there is still considerably more work that needs to be done in this area in order to identify further the varying nature of this contribution over grades and between subjects.

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