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ABSTRACT

Aptitude and achievement subtest scores (Ohio Survey Test) of 181 male eighth grade students were factor analyzed. Subjects were classified into four groups on the basis of ethnicity (black and white) and socioeconomic status (SES) (low and middle). Performance on nine tests developed by Guilford, as well as students' grade point averages in language arts, mathematics, history, science, and art were included in the factor analysis. It was found that the integration of mental abilities apparently varies as a function of social class and race. "Cognitive maps" of the higher performing youngsters (middle and low SES whites) contain fewer, more inclusive, intellectual factors than those of the lower performing youngsters. (Author)

COGNITIVE MAPS OF HIGH AND LOW SES, BLACK AND WHITE CHILDREN

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Considerable research has centered recently on attempts to specify patterns of individual differences in intellectual abilities; controversy has developed as certain ability patterns have been shown to interact with social class and ethnic classifications. Important work in this area has been done by Lesser, Fifer, & Clark (1965), Arthur Jensen (1968, 1969), and William D. Rohwer, Jr. (1971). New research techniques promise more sophisticated results in this area in the near future (i.e., see Bracht, 1970). For example, Crano, Kenny, & Campbell (1972) have examined patterns of mental abilities in suburban and core samples by means of the cross-lagged panel correlational technique. They argue that they are able to make inferences regarding the "preponderance of causation" between variables such as achievement and intelligence by examining correlations at more than one point in time (i.e., crossed and "lagged").

Of particular interest is their finding that the general to specific, or intelligence to achievement causal relationship holds only for the suburban sample, not for the inner-city sample of youngsters examined. Within the suburban sample, they argue, the more abstract abilities like Reading Comprehension or Language Usage on the Iowa Test of Basic Skills functioned as causal determinants of more specific skills such as Spelling, Capitalization, or Punctuation. Not so for the inner-city samples, however. Crano, et al., concluded on the basis of their data that specific concrete skills and information are not being integrated by inner-city children into higher order abstract schema, perhaps because of retardation in the simple accumulation of such skills. They state that the "orderly feedback sequence of skill acquisi-

tion and integration" apparently has been disrupted for the core sample. Dyer & Miller (1974) recently have replicated the Crano, Kenny, & Campbell results, applying the cross-lagged panel correlation technique with a sample ($\underline{N}$ = 173) of inner-city, Head Start youngsters. They found for the inner-city sample that the correlation between early achievement and later intelligence was significantly greater than that between early intelligence and later achievement, leading them to concur with Crano's, et al. conclusion that the specific to general cognitive skills sequence predominates for lower SES youngsters. Such a finding has important educational implications. For this reason, it must be subjected to careful examination. This we have attempted to do by seeking to determine if ability patterns in samples of eighth grade males would differ as a function of social class or race.

Sample

The sample was comprised of 181 eighth-grade male subjects, ranging in age from 12 years 7 months to 15 years 6 months living in a large industrial city in the northeast. Each student was classified as to race and socioeconomic level (SES). Occupational level of the family head was used in determining SES levels (following Hollingshead & Redlich, I958). Sample breakdowns are as follows: (1) male, white, low-SES ($\underline{N}$ = 38); (2) male, black, low-SES ($\underline{N}$ = 42); (3) male, white, middle-SES ($\underline{N}$ = 83); (4) male, black, middle-SES ($\underline{N}$ = 18).

Tests and Measures

Performance of students on academic achievement and academic aptitude tests (Ohio Survey Tests, 1967) was included in a factor analysis along with performance on nine tests developed by Guilford (Guilford-Zimmerman Aptitude Survey). These tests measure cognition, memory, convergent production, and divergent production. Students' grade point averages (GPA) in language arts, mathematics, history, science and art were also included. There were obtained from school records. Content analysis revealed that eight of the tasks (Verbal

and Mathematic Ability, Interpretative Reading, Word Fluency, Utility Test, Word Grouping, Naming Meaningful Trends, Verbal Comprehension) are more general or abstract in nature (General Abilities). The remaining 16 tasks appear to represent measures that can be characterized as more concrete and specific (Spelling, Grammar, Memory for Listed Nonsense Words, etc).

Procedures

A two-way analysis of variance for unequal Ns was performed for each of the 24 variables described above. Race (black vs. white) and socioeconomic level (low vs. middle SES) constituted the two independent variables. Following analyses of variance, the performance of each of the four groups on the 24 variables was factor analyzed. The method used for factor analyzing the original correlation matrices was the principal components factor analysis. Multiple R squares were used as communality estimates. The number of factors allowed to emerge was determined by eigenvalues greater than unity. The unrotated factor matrices were rotated using Varimax criteria (Kaiser, 1958). Factor loadings of .30 and above were deemed high enough to consider those variables with such loadings to be related to the factor. Rotated factor solutions were compared one to another using program Relate (Veldman, 1967).

Results

Both SES and race constituted significant sources of variance. White students outperformed black students ($p < .05$) on all variables except the two assessing divergent production (Word Fluency and Utility Test). Significant F values range from 4.08 for correct spelling to 58.33 and 57.72 for Mathematics Achievement and Ability, respectively. Middle SES level students performed higher than low SES level students on 16 of the 24 variables analysed ($p < .05$). F values for the SES source of variance ranged between 4.11 for Word Grouping (conceptual relationships) and 19.12 Mathematics GPA's. The only significant SES x Race interaction occurred with the Verbal Comprehension mea-

sure and can be attributed to the fact that there was less of a difference between the performance of middle-SES white students and middle-SES black students than there was between performance of low-SES white and black students. Consistent with Jensen's theory, middle and low SES youngsters did not differ in the task involving short term, rote memory (Word Recognition, Memory for Listed Nonsense Words). One surprising finding which emerged from this analysis was that the low SES white students' performance was superior to the performance of middle SES level blacks on all the variables examined. Thus, Middle SES white > Low SES whites > Middle SES black > Low SES blacks. The factors which emerged for the middle and low SES black and white subjects are listed below.

First, however, a word needs to be said regarding factor labeling. Factor labeling was facilitated by the fact that a number of tests consistently loaded together on certain factors. These "test groupings" have been defined as follows:

(1) General Abilities (9 tests)

Verbal Ability

Mathematical Ability

Achievement-Interpretive Reading

Word Fluency

Utility Test

Letter Grouping

Word Grouping

Naming Meaningful Trends

Verbal Comprehension

(2) Achievement of Specific Skills (8 tests)

Achievement--Vocabulary

Achievement--Factual Reading

Achievement--Spelling

Achievement--Effective Expression

Achievement--Grammar and Usage

Achievement--Capitalization and Punctuation

Achievement--Mathematics

Correct Spelling

(3) Memory (2 tests)

Word Recognition (identifying words that appeared on previous test)

Memory for Listed Nonsense Words

(4) Academic Performance (5 tests)

Language arts GPA

American History GPA

Mathematics GPA

Science GPA

Art GPA

The percent of total variance accounted for by each factor is indicated to the right of the factor. The number of tests from each of the categories indicated above, which have factor loadings greater than .30, is given in parentheses

Low SES, Black

1.	Achievement of Specific Skills (7 out of 8)/General Abilities (4 out of 9)	17.52
**2.	Memory (2 out of 2)	8.47
3.	Academic Performance (4 out of 5)	10.51
4.	Achievement of Specific Skills--Numerical/Spatial (3 out of 8)	10.63
5.	General Abilities--Verbal Fluency (6 out of 9)	13.13

Low SES, White

*1.	General Abilities (7 out of 9)/Academic Performance (4 out of 5)	23.17

	2. Achievement of Specific Skills (5 out of 8)	20.61
**3.	Uninterpreted--Part Memory	6.60
	4. General Abilities--Verbal Facility (5 out of 9)	13.44
	5. Academic Performance (4 out of 5)/Memory (2 out of 2)	6.88
	Middle SES, Blacks	
	1. Achievement of Specific Skills (8 out of 8)/General Abilities (3 out of 9)	26.67
**2.	Memory (2 out of 2)	13.13
	3. Academic Performance (4 out of 5)	17.27
	4. General Abilities--Verbal Facility (7 out of 9)/ Achievement of Specific Skills (5 out of 8)	15.84
	5. Uninterpreted	6.98
	Middle SES, White	
	1. Achievement of Specific Skills (7 out of 8)/ General Abilities (3 out of 9)	35.27
	2. General Abilities (8 our of 9)/ Academic Performance (5 out of 5)/ Memory (2 out of 2)	22.20

Factors which resembled each other (according to program Relate) are identified by asterisks above. The rote memory factor appears similar for low SES white and black subjects, and for middle SES black subjects.

Discussion

Middle-SES white subjects performed highest on the variables, and from the responses the fewest number of factors were extracted. Some support is found for the Crano, et al., hypothesis. Five factors emerged for low SES white and black males, and for the middle SES black male sample. From 60 to 80 percent of the variance was accounted for by these five factors. The academic performance measures load on factors separate from the general abilities measures

for the black sample, suggesting that the kinds of skills required for successful classroom performance on the part of blacks have little in common with those skills typically measured by standard ability batteries. Academic performance measures and general abilities measures load together for the low and middle SES white children. Here the specific skills involved in academic performance are apparently subsumed by more inclusive general abilites. In other words, the more abstract skills appear to be intertwined with measures of academic performance for white youngsters but not for black youngsters. One explanation for such a result is that black and white youngsters are taught differently by teachers. That is, black youngsters may simply be presented with less opportunity to use higher order cognitive skills in the classroom. This explanation is not supported, however, due to the fact that academic performance loads on a factor separate from tests of memory for black youngsters but not for white youngsters. If lower level cognitive skills were being used in the classroom by blacks, the opposite result should have been attained. Perhaps a more plausible explanation for this lack of relationship between GPAs and general abilities for blacks lies in the fact that classrooms do not consistently engage the cognitive energies of black youngsters. This suggests that other factors play a more important role in determining the academic performance of blacks in the classroom. This is consistent with the Coleman Report findings (Mosteller & Moynihan, 1972).

Turning to a second result of interest, examination of the factor loadings reveals that the general abilities measures consistently load with the specific skill measures for high SES black and white youngsters; this is not the case, however, for the low SES groups. Thus, the specific skills assessed by achievement tests are linked with the more abstract general abilities for the higher SES samples. The relative independence of these two types of measures in low SES samples as determined by factor loadings, has some important educa-

tional implications. Crano, Kenny, & Campbell (1972) argue that the interdependence of concrete and abstract skills is important for educational development:

> ...the more complex abstract abilities depend upon the acquisition of a number of diverse, concrete skills, but these concrete acquisitions, taken independently, do not operate causally to form more abstract, complex abilities. Apparently, the integration of a number of such skills is a necessary precondition to the generation of higher order abstract rules or schema. Such schema, in turn, operate as causal determinants in the acquisition of later concrete skills.(p. 272).

The fact that general abilities and specific skills load on separate factors in low SES white and black samples, and the fact that academic performance measures (i.e., GPA) load independently from the rest for black youngsters, lends some support to the Crano, et al. hypothesis. The cognitive maps of subjects performing highest on the variables can be characterized as having fewer, more inclusive intellectual factors than those performing less well.

The results of the present study indicates the need for future research which will substantiate the existence of the suspected inverse relationship between level of performance and number of factors. Such a relationship would have important implications for education. The integration of a number of diverse abilities under a few "umbrella" abilities, defined in terms of the number of factors required to account for the common variance, could be an important index of cognitive development.

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