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ABSTRACT

Differing patterns of abilities among high school males of four ethnic groups were investigated, as reflected in the interrelationships of scores on a multi-test aptitude battery. If such differences in patterns of ability exist among these groups, their existence and nature should be revealed in the interrelationships of the various test scores for each group. A 9-test Project Access battery was administered, along with a biographical inventory, to 18,000 junior-year students in Los Angeles, Memphis, and Washington, D.C. The ethnic groups studied were Black, White, Mexican-American, and Oriental, and subjects from all four groups were from low socioeconomic backgrounds. The tests measured word meaning, inductive reasoning, comparing mathematical quantities, spatial scanning, reading comprehension, grammar, following complex directions, geometric analogies, and associative memory. Principle axes procedures were applied to the correlation matrices within each ethnic group. The first five components within each group were then rotated, using Varimax procedures. The original correlation matrices are presented in the Appendix. The results of similarity among the factor loading patterns indicate that essentially the same patterns of abilities are demonstrated regardless of the ethnic identity of the examinee. (LH)

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Patterns of Ability Factors among Four Ethnic Groups

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PROJECT ACCESS RESEARCH REPORT #5

Patterns of Ability Factors among Four Ethnic Groups[1]

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When an examinee completes the items in an objective paper-and-pencil examination, he draws upon particular aspects of his past learning and experiences, utilizing those skills that he perceives to be appropriate to the task presented.

It is convenient for the constructors of such examinations to make the assumption that any particular examination causes the utilization of identical skills, no matter what the background of the examinee. This permits the measurement and assessment of any examinee on the amount of a particular skill he possesses.

In fact, however, it may not be a safe assumption that the identical nature of the stimulus for all examinees, in this case the test item, necessarily causes the same response to it with any differences being attributable to the possession of varying amounts of the required skill. French (1965) cites the example of a fourth grader and a college student taking the same test of addition: we think of the test as one of reasoning for the younger student, but one primarily of speed for the older one. Similarly, two students of the same age but with different arrangements of skills and experiences might well be measured on two different skills by the same examination.

Previous studies of cross-ethnic differences permit no generalization. Guthrie (1963) studied a group of Philippine women college students and

found some evidence for factors that would not be expected with American subjects. However, Stewart, Dole, and Harris (1967), studying public high school students in Hawaii, found a close similarity of factor structure both across ethnic groups and for males and females. More recently, Rock, Campbell, and Evans (1970) found "more similarities than differences [p. 17]" in a comparison of factor structures for Black and White medical technicians.

The present study is concerned with the investigation of differing patterns of abilities among high school males of four ethnic groups, as reflected in the interrelationships of scores on a multi-test aptitude battery. If such differences in patterns of ability exist among these groups, their existence and nature should be revealed in the interrelationships of the various test scores for each group.

Procedure

In the 1969-70 school year, a nine-test Project Access battery was administered, together with a biographical inventory, to approximately 18,000 junior-year students in three cities: Los Angeles, Memphis, and Washington, D. C. Project Access is a program sponsored by the College Entrance Examination Board and funded by the Ford Foundation, directed toward providing access to postsecondary education for minority/poverty students. Participating high schools within each city were chosen on the basis of interest and willingness to participate.

Subjects Used

Within the Los Angeles data were sufficient numbers of male students belonging to four ethnic groups, as identified by their responses on the biographical inventory, to justify separate factor analyses: Black, with

a sample size of 1,030; White, 150; Mexican-American, 400; and Oriental, 200. In general, subjects from all four groups were from low socio-economic backgrounds.

The Test Battery

The names of the nine tests and what they measure are: Vocabulary, word meaning; Letter Groups, inductive reasoning; Mathematics, comparing of mathematical quantities; Choosing a Path, spatial scanning; Reading, reading comprehension; Sentences, grammar; Year 2000, following complex directions; Figure Analogies, geometric analogies; Picture-Number, associative memory.

Analysis

Principal axes procedures were applied to the correlation matrices, with ones in the main diagonals, within each ethnic group. The first five components within each group were then rotated, using Varimax procedures. The original correlation matrices are presented in the Appendix.

Results

The first unrotated component was a general aptitude factor which varied somewhat in size across ethnic groups. That is, the first component accounted for a slightly greater proportion of the total variance in the White and Oriental groups than for the Black and Mexican-American (Table 1).

Following rotation, three of the five resulting factors were unquestionably identical across groups, differing only in the sequence of their appearance (Table 2). One large verbal common factor showed high Vocabulary, Reading, and Sentences loadings, with Year 2000 somewhat less. A unique space factor was found, with Choosing a Path the only dominant

loading; and finally, a second unique factor also appeared, based upon the associative memory task, Picture-Number.

The remaining two factors were quite similar for three of the four ethnic groups, but varied somewhat for the Oriental group. For Black, White, and Mexican-American, a reasoning factor appeared with highest loadings on Letter Groups and Mathematics, and a separate factor on which Figure Analogies dominated. For the Oriental group, however, the latter two factors were less clearly differentiated. In this case the factor that showed highest loadings for Figure Analogies also included high loadings on Mathematics and Letter Groups, while the remaining factor showed modest loadings for Letter Groups and Year 2000, and little else.

The only obvious distinction among the ethnic groups, therefore, and this not a dramatic one, is the interrelationship of the tests measuring reasoning aptitudes and related skills: for the Oriental group only, Figure Analogies, Letter Groups, and Mathematics tended to measure much more of the same dimension than in the other groups, in which Figure Analogies tended to be more isolated factorially.

A somewhat less apparent distinction between groups was the loading pattern of the Year 2000 test. It was found to have a larger unique variance component for all groups except the Oriental, where 90% of its total variance was explained by the five factors (Table 2).

Conclusions

The similarity among the factor loading patterns would indicate that essentially the same patterns of abilities are being demonstrated regardless of the ethnic identity of the examinee. The inclusion of a wider

variety of measures, or a different selection of ethnic groups, might yield different results. However, this study seems to indicate that, at this age level, the factorial structure elicited by objective examinations does not differ significantly among the more predominant ethnic groups of the country. Until evidence to the contrary can be discovered, the assumption of similar structures seems justified.

References

French, J. W. The relationship of problem-solving styles to the factor composition of tests. Educational and Psychological Measurement, 1965, 25, 9-39.

Guthrie, G. M. Structure of abilities in a non-western culture. Journal of Educational Psychology, 1963, 54, 94-103.

Rock, D. A., Campbell, J. T., and Evans, F. R. Prediction of job performance for Negro and white medical technicians. Project Report 70-17, Princeton, N. J.: Educational Testing Service, 1970.

Stewart, L. H., Dole, A. A., and Harris, Y. Y. Cultural differences in abilities during high school. American Educational Research Journal, 1967, 4, 19-30.

Footnote

[1]To be presented at the 80th Convention of the American Psychological Association, Honolulu, September 1972.

Table 1

Percentage of Total Variance Accounted for by First Five Unrotated Principal Components

Factor	Black	White	Mexican-American	Oriental
I	54.19	59.53	51.89	57.28
II	65.86	70.13	63.04	71.17
III	75.48	79.87	73.37	79.13
IV	82.64	85.23	79.95	85.99
V	87.34	89.32	85.00	89.95

Table 2

Varimax Factors for Four Ethnic Groups

	I	II	III	IV	V	h^2
Black (N = 1,030)						
Vocabulary	90	12	04	17	01	.8559
Letter G	27	84	08	29	08	.8754
Reading	85	25	12	20	05	.8419
Math	58	58	13	31	05	.7883
Sentences	78	36	06	18	02	.7744
Year 2000	61	60	19	03	09	.7772
Path	11	12	97	12	06	.9854
Figure A	34	32	16	85	03	.9670
Picture-N	04	08	06	02	99	.9921
Sum of Squared Loadings	3.0516	1.7317	1.0491	1.0197	1.0046	7.8567
White (N = 150)						
Vocabulary	87	13	13	18	14	.8427
Letter G	42	81	22	19	14	.9366
Reading	85	24	25	02	13	.8599
Math	54	51	48	11	14	.8138
Sentences	83	30	23	03	07	.8376
Year 2000	69	44	27	21	04	.7883
Path	14	11	14	01	97	.9923
Figure A	36	23	85	18	19	.9735
Picture-N	12	14	13	97	01	.9919
Sum of Squared Loadings	3.2760	1.3589	1.2430	1.0994	1.0593	8.0366

Table 2 (continued)

Varimax Factors for Four Ethnic Groups

	I	II	III	IV	V	h^2
Mexican-American (N = 400)						
Vocabulary	85	27	03	08	07	.8076
Letter G	30	26	85	15	14	.9222
Reading	81	23	26	07	04	.7831
Math	50	47	48	18	11	.7458
Sentences	83	07	33	06	-02	.8067
Year 2000	57	43	16	31	18	.6639
Path	12	15	13	96	00	.9754
Figure A	30	87	25	14	02	.9294
Picture-N	06	05	11	01	99	.9924
Sum of Squared Loadings	2.8404	1.3860	1.2474	1.1072	1.0515	7.6325
Oriental (N = 200)						
Vocabulary	94	14	06	02	-01	.9073
Letter G	21	68	15	13	57	.8708
Reading	81	28	08	09	30	.8390
Math	43	73	15	16	29	.8415
Sentences	78	32	11	06	29	.8106
Year 2000	57	31	20	19	65	.9060
Path	11	25	94	14	12	.9922
Figure A	86	89	23	15	06	.9387
Picture-N	07	18	14	97	09	1.0059
Sum of Squared Loadings	2.7781	2.1788	1.0632	1.0601	1.0318	8.1120

Appendix A

Correlations of Aptitude Test Scores for Four Ethnic Groups

Black Males

		1	2	3	4	5	6	7	8	9
1	Vocabulary									
2	Letter G	.46								
3	Reading	.77	.55							
4	Math	.62	.66	.69						
5	Sentences	.70	.56	.74	.70					
6	Year 2000	.61	.58	.66	.68	.64				
7	Path	.19	.27	.27	.30	.23	.30			
8	Figure A	.49	.59	.55	.63	.54	.54	.33		
9	Picture-N	.06	.17	.11	.13	.09	.16	.13	.09	

White Males

		1	2	3	4	5	6	7	8	9
1	Vocabulary									
2	Letter G	.60								
3	Reading	.76	.63							
4	Math	.65	.71	.71						
5	Sentences	.74	.65	.80	.69					
6	Year 2000	.69	.69	.75	.72	.73				
7	Path	.28	.31	.31	.34	.26	.25			
8	Figure A	.54	.62	.59	.69	.58	.61	.38		
9	Picture-N	.29	.37	.21	.33	.23	.37	.07	.36	

Correlations of Aptitude Test Scores for Four Ethnic Groups

Mexican-American Males

		1	2	3	4	5	6	7	8	9
1	Vocabulary									
2	Letter G	.44								
3	Reading	.70	.54							
4	Math	.57	.63	.63						
5	Sentences	.66	.50	.70	.60					
6	Year 2000	.56	.53	.59	.61	.53				
7	Path	.23	.32	.25	.36	.22	.37			
8	Figure A	.50	.55	.53	.64	.47	.53	.36		
9	Picture-N	.13	.25	.13	.21	.10	.20	.06	.14	

Oriental Males

		1	2	3	4	5	6	7	8	9
1	Vocabulary									
2	Letter G	.37								
3	Reading	.75	.55							
4	Math	.49	.72	.67						
5	Sentences	.73	.56	.74	.65					
6	Year 2000	.59	.67	.73	.71	.73				
7	Path	.20	.42	.29	.43	.31	.41			
8	Figure A	.38	.71	.50	.76	.54	.58	.49		
9	Picture-N	.13	.34	.23	.35	.22	.32	.33	.35	