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ABSTRACT

Student achievement as reflected in standardized test scores is not a unitary construct, but a set of interdependent components representing degrees of knowledge of various subject areas. The interdependency of achievement components imply a positive feedback process. Weaknesses in one area reinforce weaknesses in others; strengths in one area reinforce strengths in other areas. Structures of achievement battery component scores were related to ethnic group differences by using discriminant analyses of Iowa Tests of Basic Skills major skill area scores from each of six grade levels. Vocabulary was identified as a key component of achievement related to ethnic group differences, reflecting the persistent handicaps experienced by black and Mexican American students. Mexican American students seemed strong in math relative to black and white students when linguistic differences were controlled. The findings suggest a need for further investigation in the area of ethnic group differences. (Author/KMF)

ETHNIC GROUP DIFFERENCES ON THE ITBS: A STRUCTURAL ANALYSIS IN GRADES THREE THROUGH EIGHT

Paper Submitted to the 1981 Annual Meeting of the Southwest Educational Research Association

by

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INTRODUCTION

A great deal of research has been conducted on the social and cultural antecedents of minority student achievement (e.g. Bradley and Bradley, 1977; Hernadez, 1973). Very little attention, however, has been directed toward the structure of achievement score differences between ethnic groups. The consistency and resistance of ethnic achievement score differences to instructional impact warrant structural description.

Student achievement as realized in scores on standardized test batteries is not global. Achievement tests often haphazardly combine different components that reflect degrees of knowledge of various subject areas into a "composite" or "total" score for convenience. The interrelationships of student achievement components, as reflected in the intercorrelations of the various tests in an achievement battery, may imply a positive feedback cycle. That is, strengths in one component may reinforce the others; weaknesses in one detract from the others.

The relationships of these components to ethnic group membership can provide cues for instructional intervention. Identification of the subject areas most strongly associated with ethnic group differences, followed by effective instructional intervention, may take advantage of positive feedback processes to strengthen the whole achievement structure.

This paper is concerned with the structure of ethnic group differences on the Iowa Tests of Basic Skills (Hieronymous, Lindquist, and Hoover, 1977). Discriminant analyses were used to identify these structures in cross-sectional data from grades three through eight. The discussion comments on the nature and stability of the structures.

INSTRUMENTS

The Iowa Tests of Basic Skills have five major skill area subtests: vocabulary, reading comprehension, language, work-study skills, and mathematics. The latter three are composites of more specific skill area subtests.

SAMPLE

The ITBS was administered to approximately 5,000 students in each of grades three through eight as part of the standardized testing program in a large urban school district. Form 8 of the ITBS was administered in grades three, four, and five, and form 7 in grades six, seven, and eight. A random sample of half the students tested at each grade level was drawn for the analysis.

METHODS

Discriminant analyses between groups of Mexican American, Black, and White students were run on the five ITBS major skill area test scores expressed as grade equivalents at each grade level. The SPSS DISCRIMINANT program (Release 8) was used for the analysis.

RESULTS

The discriminant weights assigned to the five major ITBS skill areas in grades three through eight are shown in Table 1 under the heading Discriminant Function One. The results are consistent across grade levels; the vocabulary subtest contributed most to distinguishing between Mexican American, Black, and White students. Discriminant Function Two gave most weight to the mathematics subtest across all grade levels except grade eight.

The discriminant analyses provided a clear structure for ethnic group differences on the major skill area tests of the ITBS. Function one contrasts Black and Mexican American students with White students. Function two contrasts Mexican American students with White and Black students.

DISCUSSION

Based on the results reported above the structural differences in achievement test scores between the three ethnic groups may be characterized as follows:

Description 1 (Function One)

Most of the differences between the ethnic groups may be characterized by the first discriminant function. Heaviest weight is placed on the vocabulary test with smaller contributions from reading, language, work-study, and mathematics. Scores on this function contrast Mexican American and Black students with White students. The weights suggest that differences in vocabulary scores may account for much of the observed relationship between ethnic group membership and achievement.

Description 2 (Function Two)

To a much smaller extent than above the differences between the ethnic groups may be characterized by the second discriminant function. Heaviest weight is generally placed on the mathematics test. Relatively large weights of opposite sign are assigned to one or more of the more language involved tests: vocabulary, reading, or language. This function appears to adjust scores on the math test for language, contrasting Mexican American students with Black and White students.

The analyses support certain intuitive ideas about the ways in which these groups might be expected to differ. For example, the first function appears to reflect linguistic differences of a very basic kind, vocabulary, that seem to permeate performance in the other areas. The consistency of the first functions across grade levels and the magnitudes of their cannonical correlations with group membership suggest that these vocabulary related differences reflect a persistent handicap to Black and Mexican American students.

The second function appears to point out a relative strength of Mexican American students. Across grade levels the second functions tend to contrast math with the more language involved tests. In effect, they indicate that Mexican American students seem strong in math relative to Black and White students when linguistic differences are "controlled."

The paper has been concerned only with the identification of the structure of student achievement components that reflect ethnic group differences on the ITBS. An intuitively sensible structure was found to hold across grade levels, from a cross-sectional perspective. Vocabulary test scores were identified as a

key to the observed differences between ethnic groups.

Once an achievement component such as vocabulary has been identified as a key to group differences, several steps remain. First, the relevant items should be analyzed in detail for consistent item types and error patterns that account for group differences. Second, instructional intervention should be planned and implemented on a pilot basis in the deficient group or groups. Third, the impact of the intervention should be assessed by looking for changes in the achievement structure related to ethnic group differences and a drop in the correlation of the structure with ethnic group membership.

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TABLE 1

DISCRIMINANT FUNCTION ONE*

GRADE	3	4	5	6	7	8
Vocabulary	-.70	-.67	.80	-.54	-.58	-.62
Reading Comp.	-.05	-.11	.09	-.34	-.06	.00
Language	-.06	.17	.07	.13	.06	.11
Work-Study	-.19	-.36	.15	-.17	-.26	-.25
Mathematics	-.07	-.09	-.05	-.19	-.29	-.35
Cannonical R	.43	.46	.51	.51	.55	.51
			GROUP CENTROIDS			
Mexican Amer.	.43	.38	-.51	.41	.45	.27
Black	.48	.57	-.59	.62	.68	.67
White	-.50	-.53	.63	-.62	-.70	-.60
			BISCRIMINANT FUNCTION TWO**			
Vocabulary	.85	.52	.30	.87	.99	1.11
Reading Comp.	.39	.78	.79	-.35	-.07	.03
Language	.01	.78	.82	.34	-.16	.27
Work-Study	.17	-.95	-1.07	.55	.49	-.41
Math	-1.62	-1.19	-1.05	-1.53	-1.36	-1.08
Cannonical R.	.08	.10	.11	.11	.09	.07
			GROUP CENTROIDS			
Mexican Amer.	-.16	-.21	-.20	-.22	-.19	-.15
Black	.07	.09	.10	.09	.07	.04
White	.00	.01	.01	.01	.01	.02

* $P \leq .01$ at all grave levels

** $P \leq .01$ in grades three through seven; $P \leq .05$ in grade eight