DOCUMENT RESUME

ED 362 574 TM 020 648

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TITLE Investigating Ethnic Bias in the Mathematics Portion of the Exit-Level Texas Assessment of Academic Skills.
PUB DATE Mar 93
NOTE 30p.; Version of a paper presented at the Annual Texas Testing Conference (7th, Austin, TX, March 1-3, 1993).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Academic Achievement; Black Students; Comparative Testing; Elementary Secondary Education; Ethnic Groups; Grade 11; *Graduation Requirements; High Schools; *High School Students; Hispanic Americans; *Mathematics Tests; *Racial Differences; Reading Tests; State Programs; *Test Bias; Testing Programs; Urban Schools; White Students
IDENTIFIERS African Americans; *Exit Examinations; Hispanic American Students; *Texas Assessment of Academic Skills

ABSTRACT

This study examines the October 1991 exit-level Texas Assessment of Academic Skills (TAAS) mathematics results of 18,290 11th-grade Hispanic Americans, African Americans, and White non-Hispanic Americans from Texas urban districts. Substantial differences existed in the passing rates of the three ethnic groups. The passing rate for White non-Hispanics was 79 percent; for Hispanics, 48 percent; and for African Americans, 40 percent. To explore the differences in passing rates, the researcher controlled for mathematics course placement and semester grade, which reduced, but did not eliminate the gaps among ethnic groups. Across all cells, the median difference in passing rates between Hispanics and White non-Hispanics was 18; between African Americans and White non-Hispanics it was 25.5. When another control, passing or failing the exit-level TAAS reading test, was added, the gap was further reduced, but not eliminated. Hispanic and White non-Hispanic passing rates still differed by 11.5, and those for African American and White non-Hispanics differed by 19.5. Various explanations are discussed for the persistence of these gaps, including differential preparation of ethnic groups in the same course and cultural bias in the TAAS. Fourteen tables present study findings. (Contains 20 references.) (SLD)

INVESTIGATING ETHNIC BIAS IN THE MATHEMATICS PORTION OF THE EXIT-LEVEL TEXAS ASSESSMENT OF ACADEMIC SKILLS

by

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A preliminary version of this paper, "Using control variables in disaggregating Exit-Level TAAS mathematics results," was presented at the Seventh Annual Texas Testing Conference, Austin, Texas, March 1-3, 1993.

The opinions expressed here are not intended to represent the Ysleta Independent School District or any of the sponsors of the Annual Texas Testing Conference.

ABSTRACT

**INVESTIGATING ETHNIC BIAS
IN THE MATHEMATICS PORTION OF
THE EXIT-LEVEL TEXAS ASSESSMENT OF ACADEMIC SKILLS**

This study examines October 1991 Exit-level TAAS mathematics results of 18,290 eleventh grade Hispanics, African Americans and white not Hispanics from Texas urban districts. Substantial differences existed in the passing rates of the three ethnic groups. The passing rate for white not Hispanics was 79%, for Hispanics 48%, and for African Americans 40%.

In an attempt to explain the differences in passing rates, the researcher controlled for mathematics course placement and semester grade. This reduced but did not eliminate the gaps among ethnic groups. Across all cells the median difference in passing rates between Hispanics and white not Hispanics was 18; between African Americans and white not Hispanics it was 25.5.

Then the investigator added another control, passing or failing the Exit-level TAAS reading test. This reduced the gap further, but did not eliminate it. Hispanic and white not Hispanic passing rates still differed by 11.5; those for African Americans and white not Hispanics differed by 19.5.

The author discusses various explanations for the persistence of these gaps, including differential preparation of ethnic groups in the same course, and cultural bias in the TAAS. He concludes with suggestions for further research.

INVESTIGATING ETHNIC BIAS IN THE MATHEMATICS PORTION OF THE EXIT-LEVEL TEXAS ASSESSMENT OF ACADEMIC SKILLS

INTRODUCTION

In July 1990, the summer before implementation of the Texas Assessment of Academic Skills (TAAS), the Texas Education Agency (TEA) released field test results of the three portions, writing, reading and mathematics. As Table 1 shows, the field test showed substantial differences among the passing rates in mathematics for white not Hispanic, Hispanic, and African American students. (Kirby, 1990).

Table 1. Percent of eleventh grade students passing Exit-level TAAS mathematics field test with passing score set at 60% of items correct (N = 210,000).

	Percent Passing
Black	43%
Hispanic	50%
White	68%
Total	59%

Since passing the Exit-level TAAS was to be a graduation requirement, these findings concerned educators in districts with large numbers of Hispanic and African American students. Some speculated that there might be cultural bias in the test working against those ethnic minority students. Subsequent TAAS administrations did not allay those concerns. Table 2 shows that the gaps among ethnic minority and white not Hispanic students in passing rates on the Exit-level TAAS mathematics test have persisted (Texas Education Agency, 1991, p. 29 and 1992, p. 43).

Table 2. Percent passing Exit-level TAAS mathematics test for eleventh grade students in Texas. (The decline in rates from 1990 to 1991 is due to an increase in the passing standard from 60% of items correct to 70%.)

Test Administration	White not Hispanic	Hispanic	African-American	All students
October, 1990	84%	64%	56%	74%
October, 1991	68%	41%	33%	56%

APPROACHES TO ATTRIBUTING BIAS

It is easier to allege ethnic/cultural bias than to demonstrate conclusively that it exists. Valencia (1993) cites the following definition of test bias, " . . . the systematic error in the estimation of some true test score for a group of individuals as linked by race or ethnicity (e.g., Mexican-Americans)." In fact the whole issue of cultural bias in testing is controversial because of the difficulty of determining the 'true' achievement level of a group. To the extent that we are unable to ascertain a group's 'true' score, we are unable to identify test bias.

Pedhazur cites a definition of test bias by Cleary that he says has "probably enjoyed the widest currency" (1982, 476). Cleary's definition reads,

> A test is biased for members of a subgroup of the population if, in the prediction of the criterion for which the test was designed, consistent nonzero errors of prediction are made for members of the subgroup. In other words, the test is biased if the criterion score predicted from the common regression line is consistently too high or too low for members of the subgroup (1968, p. 115).

This definition is similarly problematic in that it provides no help with the question of whether the bias inheres in the predictor or the criterion. For example, the predictor might be biased **against** a certain group, or the criterion **in favor of** the group.

Bean and Frisbee (1978) provide some guidance that is more useful from an operational point of view with their statement, "To be meaningful, research into the determinants of demographic variation by race, ethnicity, or minority group status must involve, at a minimum, some reasonable determination of the universe of variables that may be expected to afford some degree of explanatory power"(p.2). Their claim reminds us of the classical "elaboration model."

The Elaboration Model

Babbie (1992, pp. 409-428) and Rosenberg (1968) describe the Elaboration Model, so called because it involves adding variables to an analysis to make it increasingly elaborate. Paraphrasing Rosenberg (pp. 23-27) I delineate the logic of the Elaboration Model as follows: It's one thing to ask the question, "Do Hispanic and African American students have lower passing rates on the Exit-level TAAS mathematics test than white not Hispanics?" It takes no great powers of analysis to answer that question. The data show that they do, substantially, time after time. But the data that answer that question are only descriptive. They do not tell us why the differences exist.

As Rosenberg says, "While it is valuable to explain . . . a relationship [between two variables] on the basis of informed speculation, it is still more valuable to subject this speculation to systematic test. The most important systematic way of examining the relationship between two variables is to introduce a third variable, called a test factor, into the analysis . . . . The test factor, it should be stressed, is introduced solely for the purpose of increasing one's understanding of the original two-variable relationship. The aim of the analysis is to determine whether the relationship between X (the independent variable) and Y (the dependent variable) is due to Z (the test factor)" (pp. 23-24).

Another way to say this is, were it not for Z, there would be no relationship between X and Y. To test the hypothesis that there is such a Z, we first classify subjects according to the test variable, Z. In other words, we look at subjects that are the same with regard to Z. If the relationship between X and Y disappears when we look only at subjects with the same value for Z, then we have good evidence that Z is the cause of the relationship.

I have already cited Bean and Frisbee's claim that "research into the determinants of demographic variation by race, ethnicity, or minority group status must involve, at a minimum, some reasonable determination of the universe of variables that may be expected to afford some degree of explanatory power." Marks (1993, p. 161) responds with dissatisfaction to this claim arguing, "Such a starting point immediately brings to mind an endless list of variables limited only by the capacity of the data analyzer." The crux of the matter is selecting from that endless list the most appropriate variables to use.

Investigating Sex Bias in the SAT

Wainer and Steinberg (1992) do a creditable job of selecting from this 'endless list' variables which seem to afford some degree of explanatory power. In investigating sex bias in the SAT mathematics aptitude test, they compare the SAT mathematics aptitude scores of male and female college freshmen who took similar mathematics courses and received similar grades. They find

that females consistently had lower SAT mathematics scores.

They conclude

> 1. There is evidence of differential validity by sex disfavoring women on the SAT-M; women score lower, on average, than men of comparable academic performance.
>
> 2. The causes of this differential performance are not susceptible to scientific/statistical determination, at least not with data sets that might plausibly be gathered (p. 330).

Wainer and Steinberg do not emphasize a fact which I consider crucial, i.e., the purpose of the SAT is to assess competence for college work. Therefore it seems reasonable to claim that the 'true' score is the evaluation a college instructor actually gives to the student's college work. From this point of view the validity or reliability of college course grades are irrelevant. The SAT is designed to predict competence, and for all practical purposes competence is defined as course grades.

I make this point because, although I use one of Wainer and Steinberg's methods, it is more problematic in my case. I compare Exit-level TAAS mathematics passing rates for students of different ethnicities who took the same courses and received similar grades. I say that it is less defensible here than it was in Wainer and Steinberg's study since the purpose of the Exit-level TAAS is not to predict classroom performance. On the contrary, its implementation as a quality control device seems to have come about precisely because of a lack of faith in the competence and judgment of school staffs. Still, it seems reasonable that in attempting (in Bean and Frisbee's words cited above) "some reasonable determination of the universe of variables that may be expected to afford some degree of explanatory power" class assignment and associated grades should be used.

Despite the fact that Wainer and Steinberg's claim is true of many sets of test scores that "The causes of this differential performance are not susceptible to scientific/statistical power," I believe we have an obligation to examine test results for evidence of bias. In this study I investigate whether the relationships between ethnicity and Exit-level TAAS passing rates are due to variables other than ethnicity. I introduce these other variables into the analyses to see to what extent relationships between ethnicity and TAAS mathematics passing rates disappear when we look at students who have the same value on these other variables.

Following Wainer and Steinberg, I phrase my question thus: "If three groups of different ethnicities (African American, Hispanic and white not Hispanic) in the same course get the same semester grades, what was the difference in their passing rates on the Exit-level TAAS mathematics test?" If my analyses call the fairness of the TAAS into question, then they must be considered and discussed.

PRELIMINARY INVESTIGATION: ONE DISTRICT'S DATA

Economic disadvantage and Limited English Proficiency

I began with data from the Ysleta Independent School District (YISD) in El Paso. YISD's student body is 80% Hispanic, and TAAS results show substantial differences in passing rates between Hispanics and white not Hispanics (See Table 3).

Table 3. Percent of YISD grade eleven Hispanics and white not Hispanics passing Exit-level TAAS mathematics test, October 1991.

	Hispanic	White not Hispanic	Difference
Percent Passing	41.7% (N=2283)	64.3% (N=499)	22.6

Many YISD Hispanic students are also low income. I began with the hypothesis that Hispanics do poorly on TAAS primarily because of economic disadvantage. As a proxy for family income, I used classification in the free or reduced price lunch program. Then I compared TAAS passing rates of Hispanics to those of white not Hispanics within the different categories of lunch program participation. Table 4 shows the findings.

Table 4. Percent of YISD grade eleven Hispanics and white not Hispanics passing Exit-level TAAS mathematics test, October 1991, controlling for lunch program participation.

Not on free or reduced price lunch			
	Hispanic	White not Hispanic	Difference
Percent passing	44.6% (N=1086)	65.0% (N=454)	20.4
On free or reduced price lunch			
	Hispanic	White not Hispanic	Difference
Percent passing	39.0% (N=1173)	62.9% (N=35)	23.9

Table 4 shows that there is no appreciable reduction in differences between Hispanics and white not Hispanics after controlling for family income. Thus the gaps in TAAS mathematics passing rates

cannot be explained totally by referring to the students' lunch program status.

In addition to being low income, many Hispanics are also Limited English Proficient (LEP). To test whether limited English proficiency is the variable that accounts for difference in scores between Hispanics and white not Hispanics, I compared passing rates of only non-LEP students. Table 5 shows those passing rates.

Table 5. Percent of YISD grade eleven Hispanics and white not Hispanics passing Exit-level TAAS mathematics test, October 1991, non-LEP students only.

	Hispanic	White not Hispanic	Difference
Percent Passing	43.0% (N=2111)	65.0% (N=488)	22.0

Table 5 shows that controlling for LEP status also failed to reduce the gap in passing rates.

CONTROLLING FOR MATHEMATICS COURSE PLACEMENT AND SEMESTER GRADE: SIX URBAN DISTRICTS

Currently many educators consider that tracking students of different achievement levels into different courses is not effective. They argue that it does little or no good for students in higher tracks and actually works against students in lower tracks. Opponents of tracking claim that low track students are not taught the same curricula as high track students, that they are not taught as well, and that they do not have positive attitudes about it. Oakes (1985) and Oakes et al. (1990) provide substantial documentation in support of the anti-tracking position. These same authors also claim that when schools implement tracking, ethnic minority and low income students are assigned disproportionately to the lower tracks.

Therefore I looked first to course placement and course semester grade to be variables that would explain away relationships between Exit-level TAAS mathematics performance and ethnicity. Perhaps ethnic minority students were in lower level mathematics courses than white not Hispanic students and performed less well in them. Those two factors, then, could account for variations in passing rates.

Sample and Method

YISD is one of the eight largest urban school districts in Texas. I asked the other seven (Austin, Corpus Christi, Dallas, El Paso,

Fort Worth, Houston and San Antonio) to release to me their October 1991, grade eleven Exit-level TAAS mathematics results, along with data on the mathematics course(s) in which each student was enrolled during the fall semester, and the semester grade in that course. Five of them provided usable data. (Fort Worth and San Antonio did not.) Thus, with my own data on YISD, I had data on six districts.

If a student was enrolled in more than one mathematics course, I selected the lowest course on the assumption that the lowest course indicated what courses the student had completed. If the student was taking more than one mathematics course, for example, and the lowest was Geometry, I assumed that s/he had completed Algebra-I. Furthermore, since students took the TAAS in October, relatively close to the beginning of the school year, it seemed reasonable to use as a control variable a course which indicated the student's recent mathematics history.

Unfortunately, semester grades did not show how the student was doing in mathematics at the precise time s/he took the Exit-level TAAS mathematics test. But they did depend on students' performance over a substantial period of time. I used semester grades on the assumption that they were more reliable indicators than were grades for any particular six weeks, though the six weeks grades may have been assigned closer in time to the TAAS administration.

With mathematics course placement and semester grade, I had what seemed good candidates for the variable(s) that would explain the relationship between ethnicity and TAAS passing rates. If differences in percent passing TAAS among African Americans, Hispanics, and white not Hispanics disappeared when we looked at students who were in the same course getting about the same grade, then we could lay to rest perceptions that the differences were due to some ethnic bias inherent in the TAAS itself. Then Texas educators concerned about poor TAAS performance could simply focus on procedures for assigning students to mathematics courses and on strategies for promoting their success in those courses.

For this study I did several transformations of the data. I deleted records of students who were in informal geometry because it had no specific prerequisite. A student could get into informal Geometry through more than one route, so I could not tell what course the student had just finished.

I also deleted records of students who were not assigned to a mathematics course and of students who did not have valid TAAS mathematics and reading scores. (The relevance of reading will be clear shortly.) Finally, I deleted records of all but African American, Hispanic, and white not Hispanic students. Asian students do not have the history of systematic discrimination nor of school failure that African American and Hispanic students do, and there were not enough American Indians on the file to draw conclusions about them. The resulting sample was 18,290 students: 4,937 African Americans (27%), 8,510 Hispanics (47%), and 4,843 white not Hispanics (26%).

I combined all courses above Algebra II, including Computer Mathematics, into one category, "advanced." Similarly, I combined all courses below Algebra I (Fundamentals of Mathematics [FOM], Consumer Mathematics, and Pre-Algebra) into one category, "remedial." This gave me six levels of mathematics courses: Remedial, Algebra I, Geometry, Mathematics of Consumer Economics, Algebra II, and advanced.

Finally, I combined all semester grades into four categories (0-69, 70-79, 80-89, and 90-100). Thus every student fell into one of 24 categories (six course levels by four semester grades).

Findings

Table 6 shows the numbers of each ethnicity, in each course, that received each category of semester grade.

It is apparent that course placement and semester grade are both related to ethnicity. Sixty-seven percent of white not Hispanics were in Algebra II or a more advanced course, but only 40% of Hispanics and 44% of African Americans were. Similarly, 53% of white not Hispanics received semester grades of 80% or better, compared to only 40% of Hispanics and 31% of African Americans.

Table 7 shows percents passing the Exit-level TAAS mathematics test for each ethnicity, stratified by course type and semester grade. For each ethnicity, the grade effects are the difference between the percent passing at that level of semester grade and the overall passing rate for that ethnicity. For example, African American students who received semester grades of 90-100 had TAAS passing rates of 83%, 43 points above the passing rates for all African American students, which was 40%. Similarly, "Course Effects" for each ethnicity are the differences between the TAAS passing rates in each course and the overall passing rate for that ethnicity. For example, Hispanics enrolled in advanced math courses had a TAAS passing rate of 90%, 42% above the passing rate for all Hispanics, which was 48%.

Some interesting aspects of these data are:

1. Overall, African Americans had a TAAS passing rate 39 points lower than white not Hispanics. Hispanics had a passing rate 31 points lower than white not Hispanics.

2. For all three ethnicities, students in higher level courses had higher passing rates.

3. For all three ethnicities, students who received higher semester grades had higher TAAS passing rates.

Table 8 shows differences among passing rates for the different ethnicities. These differences result from subtracting the percentages in each ethnic minority table from the corresponding percentages in the white not Hispanic table. It is apparent from

Table 8 that, matched on course level and grade, African American students had TAAS passing rates from two points above to 39 points below those of white not Hispanic students, with a median difference for all cells of 25.5. Hispanic students had TAAS passing rates ranging from three to 56 points below those of white not Hispanics, with a median difference for all cells of eighteen.

I conclude from these statistics that some of the difference in passing rates among white not Hispanic and ethnic minority students is related to course placement and class performance. I conclude also that some of the difference is due to other factors.

Table 6. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991. Sample sizes by lowest level of math course, grade, and ethnicity

SAMPLE SIZES FOR AFRICAN AMERICAN STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	111	118	40	7	19	21	316	6%
80-89	230	478	308	29	110	92	1,247	25%
70-79	171	784	926	68	417	124	2,490	50%
0-69	29	246	311	19	229	50	884	18%
Total Course	541	1,626	1,585	123	775	287	4,937	
Course %	11%	33%	32%	2%	16%	6%		
Mean Grade	82%	76%	74%	75%	72%	77%		

SAMPLE SIZES FOR HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	233	294	165	30	123	78	923	11%
80-89	319	867	617	107	317	228	2,455	29%
70-79	249	1,076	1,222	149	693	257	3,646	43%
0-69	70	324	496	54	415	127	1,486	17%
Total Course	871	2,561	2,500	340	1,548	690	8,510	
Course %	10%	30%	29%	4%	18%	8%		
Mean Grade	82%	78%	75%	76%	73%	77%		

SAMPLE SIZES FOR WHITE NOT HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	438	323	66	14	19	25	885	18%
80-89	481	780	238	51	89	53	1,692	35%
70-79	255	791	512	52	141	59	1,810	37%
0-69	35	148	149	12	95	17	456	9%
Total Course	1,209	2,042	965	129	344	154	4,843	
Course %	25%	42%	20%	3%	7%	3%		
Mean Grade	85%	80%	75%	79%	73%	79%		

Table 7. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Percent passing by lowest level of math course, grade, and ethnicity

PERCENT PASSING FOR AFRICAN AMERICAN STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	97%	91%	73%	57%	37%	38%	83%	+43
80-89	81%	69%	43%	24%	28%	14%	56%	+16
70-79	71%	45%	26%	25%	18%	11%	33%	-7
0-69	55%	31%	17%	26%	14%	14%	22%	-18
Total % Passing for Course	80%	53%	29%	27%	19%	14%	40%	
Course Effects	+40	+13	-11	-13	-21	-26		

PERCENT PASSING FOR HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	97%	92%	74%	37%	42%	21%	75%	+27
80-89	91%	78%	55%	51%	28%	14%	60%	+12
70-79	86%	61%	34%	25%	19%	7%	40%	-8
0-69	84%	49%	28%	15%	11%	7%	28%	-20
Total % Passing for Course	90%	69%	40%	32%	20%	11%	48%	
Course Effects	+42	+21	-8	-16	-28	-37		

PERCENT PASSING FOR WHITE NOT HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	100%	97%	88%	93%	74%	56%	96%	+17
80-89	97%	91%	73%	59%	47%	45%	85%	+6
70-79	94%	80%	58%	50%	44%	17%	70%	-9
0-69	91%	70%	44%	33%	40%	12%	54%	-23
Total % Passing for Course	97%	86%	62%	57%	45%	33%	79%	
Course Effects	+18	+7	-17	-22	-34	-46		

Table 8. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Differences in percent passing by lowest level of math course, grade, and ethnicity

WHITE NOT HISPANIC MINUS AFRICAN AMERICAN

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Unweighted median
90-100	3	6	15	36	37	18	16.5
80-89	16	22	30	35	19	31	26.0
70-79	23	35	32	25	26	6	25.5
0-69	36	39	27	7	26	-2	26.5
Unweighted Medians	19.5	28.5	28.5	30.0	26.0	12.0	**25.5**

WHITE NOT HISPANIC MINUS HISPANIC

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Unweighted Median
90-100	3	5	14	56	32	35	23
80-89	6	13	18	8	19	31	15.5
70-79	8	19	24	25	25	10	21.5
0-69	7	21	16	18	29	5	17
Unweighted Medians	6.5	16.0	17.0	21.5	27	20.5	**18**

CONTROLLING FOR READING PERFORMANCE

Curriculum specialists have reported to me in informal conversations that they think the source of variation in scores between Hispanics and white not Hispanics is English language proficiency. English is a second language for many Hispanic students. Furthermore, much of the Exit-level TAAS mathematics test involves reading and solving word problems. At least one investigator (Mestre, 1989) has documented that some of the misconceptions which Hispanic students have about mathematics are related to lack of familiarity with English. I reported above that controlling for LEP status with YISD students accounted for almost no difference in TAAS passing rates between Hispanics and white not Hispanics. But LEP status is a fairly crude classification, identifying only the most severely limited students. I surmise that many Hispanic students who are no longer (or in fact have never been) LEP may still have more difficulties with English reading than the typical white not Hispanic student.

To test whether lack of English is related to the gaps in performance between white not Hispanic and ethnic minority students, I repeated the analyses, this time adding to course enrollment and semester grade the variable reading performance. Reading performance is simply the student's having passed or failed the TAAS Exit-level reading test administered the day before the mathematics test. Tables 9-14 show the results of that analysis. I must, however, issue two cautions about interpreting statistics from this analysis.

1. Disaggregating the data by this many variables resulted in some small cell sizes and some empty cells. Caution is essential in interpreting patterns involving cells with small Ns.

2. Using TAAS Exit-level reading in a study of possible ethnic bias in the TAAS mathematics begs the question somewhat. If the mathematics test contains ethnic bias, then perhaps the reading test does too. Thus controlling for performance on the reading test, or removing the effect of the reading test, means looking for ethnic bias in the mathematics test after removing the effect of any ethnic bias in the reading test.

Students who Failed TAAS Reading

As Table 10 shows, for students who failed TAAS Exit-level reading, there were wide disparities from cell to cell, partly due to the small Ns in some cells. The passing rates of African American students ranged from 100 points above to 100 points below those of white not Hispanics, with a median difference of 17.5 points below. For Hispanics the differences ranged from 71 points above those of white not Hispanics to 87 points below, with a median difference of fifteen points below.

Students who Passed TAAS Reading

For students who passed TAAS reading, African American passing rates compared to those of white not Hispanics ranged from four points above to 48 points below, with a median difference of 22 points below. For Hispanics the passing rates ranged from three points above to 35 points below those of white not Hispanics, with a median difference of 11.5 points below.

All Students, Controlling for TAAS Reading

Finally, I computed the medians of all differences from Tables 9 and 12 across those who failed and those who passed TAAS reading. Those figures are not shown in a table. The median difference between African Americans and white not Hispanics was 19.5; between Hispanics and white not Hispanics it was 11.5.

Table 9. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Sample sizes by lowest level of math course, grade, and ethnicity (Students who failed Exit-level TAAS reading).

SAMPLE SIZES FOR AFRICAN AMERICAN STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	4	11	3	1	8	11	38	2%
80-89	14	80	98	12	62	58	324	17%
70-79	24	248	440	40	255	91	1,098	57%
0-69	5	89	180	8	158	41	481	25%
Total Course	47	428	721	61	483	201	1,941	
Course %	2%	22%	37%	3%	25%	10%		
Mean Grade	77%	73%	72%	74%	71%	76%		

SAMPLE SIZES FOR HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	7	21	45	15	70	55	213	7%
80-89	22	96	182	41	196	161	698	22%
70-79	34	220	528	89	465	197	1,533	48%
0-69	9	97	240	35	287	106	774	24%
Total Course	72	434	995	180	1,018	519	3,218	
Course %	2%	13%	31%	6%	32%	16%		
Mean Grade	78%	73%	73%	74%	72%	76%		

SAMPLE SIZES FOR WHITE NOT HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	1	0	4	1	1	9	16	3%
80-89	3	39	22	6	30	24	124	22%
70-79	8	72	112	21	54	37	304	54%
0-69	0	24	43	5	36	12	120	21%
Total Course	12	135	181	33	121	82	564	
Course %	2%	24%	32%	6%	21%	15%		
Mean Grade	79	74%	72%	74%	72%	77%		

Table 10. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Percent passing by lowest level of math course, grade, and ethnicity (Students who failed Exit-level TAAS reading).

PERCENT PASSING FOR AFRICAN AMERICAN STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	100%	64%	67%	0%	25%	18%	45%	+30
80-89	36%	34%	19%	17%	23%	9%	22%	+7
70-79	13%	21%	13%	15%	11%	7%	14%	-1
0-69	20%	17%	9%	0%	11%	7%	11%	-4
Total % Passing for Course	28%	24%	13%	13%	13%	8%	15%	
Course Effects	+13	+9	-2	-2	-2	-7		

PERCENT PASSING FOR HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	71%	67%	51%	13%	24%	11%	32%	+15
80-89	41%	54%	26%	27%	16%	4%	23%	+6
70-79	41%	27%	16%	20%	12%	3%	15%	-2
0-69	89%	24%	10%	11%	5%	6%	11%	-6
Total % Passing for Course	50%	34%	18%	19%	12%	5%	17%	
Course Effects	+33	+17	+1	+2	-5	-12		

PERCENT PASSING FOR WHITE NOT HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	0%		75%	100%	0%	22%	38%	+3
80-89	67%	62%	32%	33%	27%	13%	37%	+2
70-79	88%	50%	36%	38%	26%	11%	36%	+1
0-69		42%	28%	20%	36%	0%	30%	-5
Total % Passing for Course	75%	52%	34%	36%	29%	11%	35%	
Course Effects	+40	+17	-1	+1	-6	-24		

Table 11. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Differences in percent passing ~, lowest level of math course, grade, and ethnicity (Students who failed Exit-level TAAS reading).

WHITE NOT HISPANIC MINUS AFRICAN AMERICAN

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Unweighted Median
90-100	-100		8	100	-25	4	4
80-89	31	28	13	16	4	4	14.5
70-79	75	29	23	23	15	4	23
0-69		25	19	20	25	-7	20
Unweighted Medians	31	28	16	21.5	9.5	4	17.5

WHITE NOT HISPANIC MINUS HISPANIC

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Unweighted Median
90-100	-71		24	87	-24	11	11
80-89	26	8	6	6	11	9	8.5
70-79	47	23	20	18	14	8	19
0-69		18	18	9	31	-6	18
Unweighted Medians	26	18	19	13.5	12.5	8.5	12.5

Table 12. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Sample sizes by lowest level of math course, grade, and ethnicity (Students who passed Exit-level TAAS reading).

SAMPLE SIZES FOR AFRICAN AMERICAN STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	107	107	37	6	11	10	278	9%
80-89	216	398	210	17	48	34	923	31%
70-79	147	536	486	28	162	33	1,392	47%
0-69	24	157	131	11	71	9	403	13%
Total Course	494	1,198	864	62	292	86	2,996	
Course %	16%	40%	29%	2%	10%	3%		
Mean Grade	82%	77%	75%	76%	73%	79%		

SAMPLE SIZES FOR HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	226	273	120	15	53	23	710	13%
80-89	297	771	435	66	121	67	1,757	33%
70-79	215	856	694	60	228	60	2,113	40%
0-69	61	227	256	19	128	21	712	13%
Total Course	799	2,127	1,505	160	530	171	5,292	
Course %	15%	40%	28%	3%	10%	3%		
Mean Grade	82%	79%	76%	78%	74%	79%		

SAMPLE SIZES FOR WHITE NOT HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Totals	Grade Percent
90-100	437	323	62	13	18	16	869	20%
80-89	478	741	216	45	59	29	1,568	37%
70-79	247	719	400	31	87	22	1,506	35%
0-69	35	124	106	7	59	5	336	8%
Total Course	1,197	1,907	784	96	223	72	4,279	
Course %	28%	45%	18%	2%	5%	2%		
Mean Grade	85%	81%	76%	80%	74%	82%		

Table 13. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Percent passing by lowest level of math course, grade, and ethnicity (Students who passed Exit-level TAAS reading).

PERCENT PASSING FOR AFRICAN AMERICAN STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	97%	94%	73%	67%	46%	60%	89%	+33
80-89	84%	76%	54%	29%	35%	24%	68%	+12
70-79	81%	56%	37%	39%	30%	21%	48%	-8
0-69	63%	39%	28%	46%	21%	44%	34%	-12
Total % Passing for Course	85%	64%	41%	40%	29%	29%	56%	
Course Effects	+29	+8	-15	-16	-27	-27		

PERCENT PASSING FOR HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	97%	94%	83%	60%	66%	44%	89%	+22
80-89	94%	81%	67%	65%	47%	37%	75%	+8
70-79	93%	70%	47%	32%	32%	23%	58%	-9
0-69	84%	60%	44%	21%	23%	14%	48%	-19
Total % Passing for Course	94%	76%	55%	47%	37%	30%	67%	
Course Effects	+27	+9	-12	-20	-30	-37		

PERCENT PASSING FOR WHITE NOT HISPANIC STUDENTS

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Grade Totals	Grade Effect
90-100	100%	97%	89%	92%	78%	75%	97%	+13
80-89	97%	92%	77%	62%	58%	72%	89%	+5
70-79	94%	83%	64%	58%	55%	27%	77%	-7
0-69	91%	76%	51%	43%	42%	40%	63%	-21
Total % Passing for Course	97%	89%	68%	64%	54%	57%	84%	
Course Effects	+13	+5	-16	-20	-30	-27		

Table 14. Exit-level TAAS examinees in six Texas urban school districts, Grade eleven, October 1991: Differences in percent passing by lowest level of math course, grade, and ethnicity (Students who passed Exit-level TAAS reading).

WHITE NOT HISPANIC MINUS AFRICAN AMERICAN

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Unweighted median
90-100	3	3	16	25	32	15	15.5
80-89	13	16	23	33	23	48	23
70-79	13	27	27	19	25	6	22
0-69	28	37	23	-3	21	-4	22
Unweighted Medians	13	21.5	23	22	24	10.5	22

WHITE NOT HISPANIC MINUS HISPANIC

Grade at end of 1st semester	All Advanced Courses	Algebra II	Geometry	Mathematics of Consumer Economics	Algebra I	FOM, Consumer math, or Pre-Algebra	Unweighted Median
90-100	3	3	6	32	12	31	9
80-89	3	11	10	-3	11	35	10.5
70-79	1	13	17	26	23	4	15
0-69	7	16	7	22	19	26	17.5
Unweighted Medians	3	12	8.5	24	15.5	28.5	11.5

DISCUSSION

Gaps remain in the TAAS mathematics performance of African American, Hispanic, and white not Hispanic students, even after controlling for course placement, semester grade, and reading performance. In comparing Hispanics to white not Hispanics, we started with a gap of 31 points; controlling for course placement and grade reduced the gap to a median for all cells of 17 points; and adding reading performance to our analysis produced a median gap of 11.5. For African American students the situation was bleaker. We started with a gap of 39 points; controlling for course placement and grade reduced the median gap to 25.5; adding reading performance left us still with a median gap of 19.5. Having failed to explain away all the differences by systematic empirical analyses, I am reduced to Rosenberg's "informed speculation."

The Validity of Course Placements and Semester Grades

At this point, I must face Bean and Frisbee's 'reasonable determination of the universe of explanatory variables,' Valencia's reference to 'some true score,' and my own comment above that Cleary's definition of test bias leaves open the question of whether the it is the predictor or the criterion variable that is biased for a specific group. In other words, I must consider to what extent course placements and semester grades are invalid or unreliable reflections of students' mathematics achievements, and whether the TAAS, in fact, serves as a valuable check on misperceptions that students in the same course getting the same grade have similar 'true' mathematics achievement.

We can speculate that across these six Texas urban districts, schools are systematically being overly optimistic in assigning ethnic minority students to mathematics courses, and/or teachers are instructing them less effectively, and/or grading them more leniently. At first glance such an occurrence seems unlikely. After all, this study involves ethnicities that have histories of discrimination in our country, and cultures which are undervalued by many in the mainstream culture. From that point of view it seems unlikely that schools are optimistic in assignments or that teachers are generous in assigning grades.

On the other side of the argument, however, Oakes (1985) inferred from her data that in lower tracks of the curriculum, teachers in fact desired lower levels of thinking from their students and desired them to gain knowledge which Oakes describes as "lower status" (pp. 82-83). In a later work (Oakes et al., 1990) she cites data to make the following point: Though in general, schools tend to place their better teachers with their higher tracks of students, schools which serve large proportions of minority students don't have as good a pool of teachers to draw from. So

minority students not only end up disproportionately in lower tracks (as Oakes documents and as the data in this study confirm), but across all tracks, ethnic minority students may have restricted access to the better teachers and instruction.

It is conceivable, therefore, that across the range of schools in Oakes' study, a 'B' in Algebra II awarded to an ethnic minority student, for instance, did not equal the same amount or kind of learning as a 'B' in Algebra II awarded to a white not Hispanic. If this phenomenon occurred in the Texas urban school districts in this study it is likely that the different passing rates on the mathematics Exit-level TAAS merely reflect the real difference in the mathematics knowledge represented by the 'B' in Algebra II awarded to students of different ethnicities.

On the other hand, Oakes et al. did their study on a broad national sample of schools. My sample consisted of large urban school districts in Texas, which may have contained a narrower range of conditions than Oakes et al. encountered. To the extent that such is the case, it is harder to believe that within this range of conditions, specific grades given in specific courses to students of different ethnicities represent substantially different levels of achievement.

Cultural Bias in Questions

These analyses have not accounted for all the differences in passing rates of white not Hispanic and ethnic minority students, and therefore this study has left open the question of whether the Exit-level TAAS mathematics test contains ethnic or cultural bias. Furthermore, the TAAS is a secure test, and thus test items cannot be subjected to discussion among ethnic minority students and researchers as to why they are difficult. As long as the TAAS remains secure, investigators will have little recourse but to indulge in informed speculation.

But the work of others points to some possible explanations of how such cultural bias might be operating. Heath (1982 and 1983), after studying southern working class black and biblical fundamentalist white families, argued that for students from both populations, the questions heard in school were drastically different from those they heard in their homes.

Werner and Schoepfle (1987) recount interviewing Navajos to produce an encyclopedia of their medical knowledge. When they showed a draft of their encyclopedia to Navajos, the Navajos were surprised at how the material was organized, from head to foot,

> 'Don't you know,' many of them said, 'that the human body must be described just like in the ceremonies, starting with the foot, the leg, the hips, the trunk, . . . and finally, the head? This is the direction of life and growth; it is from the part closest to the earth to the top' (p. 132).

Gilligan (1982) recounts the results of asking eleven-year-old children to resolve an ethical dilemma, i.e., is it better to steal medicine to save someone's life, or to let the person die to avoid becoming a thief? A boy treated the dilemma as a legal issue, that it was better to steal the medicine, but that there was a problem in the law which would punish someone for stealing to save a life. A girl " . . . seeing a world comprised of relationships rather than of people standing alone, a world that coheres through human connection rather than through systems of rules . . . considers the solution to the dilemma to lie in making the wife's condition more salient to the druggist or, failing, in appealing to others who are in a position to help" (p. 28). It strikes me that if that question was asked in a multiple choice format, scores of girls and boys might differ because of differences in their visions of the world, not because of a lack of understanding of ethics.

For this writer those three examples illustrate increasing levels of problems with administering multiple choice tests to culturally or psychologically different populations. After reading Heath's accounts, I am not prepared, nor was Heath, to argue that the questions asked in the working class black and biblical fundamentalist white families were just as 'good' as the questions asked in school and that therefore the schools should require no different types of questions of culturally different students. Her study merely illustrates the difficulties which some school questions have for such students.

The Navajo incident raises a more serious issue. I submit that it is purely arbitrary whether knowledge about the body be organized from the head down or from the feet up. But if a test maker arbitrarily assumed that it was appropriate to organize material about the human body from the head down, and a Navajo student was nonplussed by the sight of such an organization because it differed from his/her arbitrary organization, the test might well underestimate what s/he actually knew.

Finally, upon considering Gilligan's example, I submit that the students could have difficulty with a test item because their grasp of the complexity of an issue could be better developed than the test maker's. The test author could see the question only in the terms described by the young boy, as a problem in logic or law. It is arguable that the more common and therefore more important moral issues we face daily as human beings revolve less around logical resolutions of contrived textbook situations and more around maintaining justice and dignity in our relationships with the people we encounter. Therefore, I submit that if in fact the question were asked with only two choices, 'steal the medicine,' and 'let the person die,' it would be omitting a right answer (the girl's) which is perfectly reasonable, which interjects the voice of restraint into a situation which could otherwise lead to confrontation and injury, and which Gilligan argues is more likely to occur to females than to males.

Neither of the cited authors was specifically discussing

standardized multiple choice tests. But they bring insights to bear on different approaches to answering questions among different groups. Their insights make it credible that with the rigid format of a multiple choice test there might easily be questions which pose particular difficulties to students from different backgrounds, apart from each student group's knowledge of the content tested.

Certainly there is now evidence that the multiple choice format can be particularly easy for some examinees. Jacobsen (1993) reports on research with students attempting to answer multiple choice reading questions without first reading the passages to which the questions referred. Students answered questions correctly at rates substantially better than would be expected on the basis of chance. The researchers argue that

> 'factors having nothing to do' with the comprehension of reading passages--specifically background knowledge and test-taking skills--are responsible for the better-than-chance success rates achieved by many of the dozens of students they tested' (p. A34).

If it is true that students with the 'right' background knowledge and test taking skills can answer questions without having read the specific passage(s) to which the questions refer, it seems equally likely that students with different background knowledge and experience may have unusual difficulty answering questions even over material they do read and understand.

CONCLUSIONS

The findings reported here neither prove conclusively that the Exit-level TAAS mathematics test is biased, nor exonerate it from accusations of bias. From the viewpoint of the African American or Hispanic student who takes the recommended courses and gets satisfactory grades, however, it must seem unfair to face greater odds of failing the TAAS than does the white not Hispanic with apparently similar preparation. The data, along with Oakes' studies, suggest that Texas urban school districts need to be vigilant in providing all students equal opportunities to learn the mathematics tested by the TAAS, though some problems, such as access to a pool of high quality teachers, may be beyond districts' control.

In addition to the efforts districts should make, these analyses suggest that the Texas Legislature, State Board of Education, and Texas Education Agency must be vigilant to check for and guard against possible bias in the TAAS. The Exit-level TAAS stands between students and high school graduation. If it is biased against ethnic minority students, it serves not to improve educational opportunities for such students, but to deny them.

RECOMMENDATIONS FOR FURTHER RESEARCH

To my knowledge, this is the first study to compare Exit-level TAAS mathematics performance by ethnicity, controlling for educational preparation variables. My findings, though inconclusive, are disturbing, and suggest three other investigations of possible ethnic or cultural bias in the TAAS.

1. TEA has Public Information Management System (PEIMS) data on the entire state of Texas. TEA could replicate the analyses in this study on a larger scale and even elaborate upon them using other explanatory variables.

2. TEA submits TAAS test items to discussion and analysis by review panels of teachers and curriculum specialists, and routinely includes ethnic minority educators on those review panels. But college educated ethnic minority adults, who have coped successfully with mainstream school systems, may miss assumptions, wordings, and nuances which would cause difficulty for younger, less experienced students. TEA ought to have panels of ethnic minority students review the items in similar fashion and report their reactions to trained ethnographers. Such a process might alert test developers to problems in the TAAS tests that ethnic minority educators and other adults miss.

3. TAAS test security is likely to remain tight, and TEA will continue to enjoin students and school staffs from examining and discussing specific items. Nonetheless, the TAAS test experience can and should be discussed. Following Merton et al. (1990) I suggest that investigators conduct focused interviews with ethnic minority students as they emerge from taking the TAAS. Focused interviews prompt subjects to discuss their perceptions and feelings about an experience that has just occurred. Interviewers encourage subjects to express their feelings freely, but constantly urge them to stick to the point, i.e., the recent event. Thus, the interview is focused on the " . . . subjective experiences of persons exposed to the . . . situation in an effort to ascertain <u>their definitions of the situation</u>" (Merton, p. 3). Neither the student nor the interviewer would need to reveal the content of particular test items, but the method has promise in the effort to learn why ethnic minority students are failing the TAAS at such high rates, despite preparation, apparently equivalent to that of their white not Hispanic counterparts.

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