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AUTHOR Kubiak, Anna; And Others
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ABSTRACT

Whether stratifying gender and ethnic groups according to educational variables in the examinees' backgrounds adds information to the differential item functioning (DIF) process for the verbal and quantitative sections of a graduate admission test was explored using data from a 1990 graduate admission test. DIF analyses were performed on the following groups using the Mantel Haenszel procedure: (1) 4,282 males; (2) 6,419 females; (3) 9,267 Whites; (4) 416 African Americans; (5) 368 Hispanic Americans; and (6) 341 Asian Americans. Males and Whites served as the reference groups for females and minority groups, respectively. Undergraduate major and coursework in English and mathematics were the educational variables selected. The study was begun with the idea that a more homogeneous population might decrease the number of items with DIF, but research does not entirely support the original hypothesis. In many cases, the number of items with DIF remained the same or increased when a more homogeneous population was analyzed. Coursework analyses were not as clear as had been expected. Some of the DIF did appear to be explainable, and the contribution of background variables to DIF may be elucidated by further study. Included are 33 tables of DIF analysis results and 9 graphs illustrating comparisons among groups. (SLD)

The Effects of Using Educational Background Variables in DIF Analyses

Anna Kubiak
Kathleen O'Neill
Carmen Payton

Educational Testing Service

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Objectives and Theoretical Framework

Over the last several decades, much research has been done in the general area of test fairness and in the particular area of differences in performance between subgroups of examinees. Differential item functioning (DIF) research conducted within the last ten years has utilized a variety of procedures to study the performance of examinees with similar levels of knowledge and/or ability. Recent advances in empirical methods for detecting DIF have been made by researchers such as Scheuneman (1979) and Marascuilo and Slaughter (1981) who compared item performance by groups conditioned on ability, using a chi-square approach. Stricker (1982) has controlled for ability using a partial correlation approach, and others have used item response theory (IRT) for detecting regions of the ability distribution where the performance of subgroups differs (e.g., Linn, Levine, Hastings, and Wardrop, 1981; Thissen, Steinberg, and Wainer, 1988). At ETS the two DIF techniques used operationally to identify items for which issues of test fairness may be involved are the Mantel-Haenszel procedure (discussed by Scheuneman and Bleistein, 1989) and the standardization approach (Dorans and Kulick, 1986).

DIF procedures often use the total test score as the criterion on which examinees are compared since it is a good measure of ability for the construct being assessed and it is readily available. However, other variables related to educational background may contribute additional information to the understanding of differential functioning of items. Previous research by Kulick and Dorans (1983) and Secolsky, Chandler, and Fulton (1989) suggests that background variables may be helpful in understanding differentially functioning items. These st udies investigated whether self-reported parents' educational level, which operationalized socioeconomic status, may be contributing to the differences in performance of African-American and White examinees. In the Secolsky, Chandler, and Fulton research, some items had much larger DIF values in the African-American/White analyses stratified by education than in the operational African-American/White analyses which compared the two total groups. For some of these items, test developers were able to hypothesize a rationale for the group differences that related more to socioeconomic status than to race. For example, the analogy "epidermis : mammal :: bark : conifer" showed much larger DIF

for the low education African-American group than for the high education African-American group, and it is possible that low education African-American examinees had less opportunity to become familiar with this terminology from their education or experience with nature. Although these results are interesting, they do not offer much opportunity of using the findings to aid test developers or examinees; little advice can be provided to either test developers or test-takers on the basis of parents' educational level. However, guidance might be offered to developers and examinees on the basis of educational background. Given that educational background plays a major role in the performance of all examinees, it seems worthwhile to investigate whether self-reported data about examinees' education could bring additional information to the DIF process. This information could help not only researchers and test developers who form hypotheses about the causes of DIF but also students who seek advice in their preparations for advanced study.

This study explores whether stratifying gender/ethnic groups according to educational variables in the examinees' background adds information to the DIF process for the Verbal and Quantitative sections of a graduate admission test. DIF data arising from this augmented procedure are used to investigate the possible causes of high DIF on items in an effort to clarify why some items receive high DIF values and others do not.

Methods and Data Sources

Description of DIF. It is standard procedure at ETS to analyze test items for their differential difficulty with regard to gender and race/ethnicity of test takers. The differential item functioning (DIF) procedure (Holland & Thayer, 1986) used at ETS is based on the Mantel-Haenszel statistical technique (Mantel & Haenszel, 1959) for studying different groups. The Mantel-Haenszel method compares the odds of two gender or racial/ethnic groups answering a test item correctly when the ability of the members estimated by test scores has been controlled for. The DIF indices aid in identifying differences in difficulty caused by characteristics of the test item itself, after real differences in pertinent knowledge and skills have been taken into account.

The two groups which are identified for the purpose of DIF analysis are referred to as the reference group (generally males and Whites) and the focal group (generally females, African-Americans, Asian-Americans, Hispanics). Members of the reference and focal groups are divided into subgroups based on the total test score. Then, the odds that a reference group member answers the item correctly are calculated for every subgroup at each score level. This calculation is repeated for members of every focal group at each score level, after which the ratio of the odds for the focal group to the odds for the reference group is calculated for each subgroup. Then, these odds ratios are averaged across the entire score scale, weighted according to the number of individuals at each score value. The estimate resulting from this procedure is the average factor by which the odds that a reference group member answers the item correctly exceeds the corresponding odds for comparable focal group members. For example, if the odds-ratio value is equal to 1, then both subgroups are equally likely to answer the item correctly or, to state it differently, the item is equally difficult for both subgroups. The MH D-DIF (Mantel-Haenszel delta difference) index, commonly used at ETS, is a scaled odds-ratio. The scale is the ETS delta scale used in test construction and analysis. Delta is a transformation of percent correct to a scale for item difficulty ranging from about 6 (very easy items) to about 20 (very difficult items). A delta value of 13 corresponds to 50 percent correct. Consequently, if MH D-DIF is equal to -1.00, it means that the item is one delta unit more difficult for the focal group than it is for comparable members of the reference group. Near the middle of the difficulty scale, a difference of 1 delta point is equivalent to about 10 percent difference in percent correct.

An item may be more difficult for the focal group or it may be easier. Based on the absolute value of MH D-DIF statistics and their level of significance (α = .05), test items are classified into three categories. The three categories are labeled A, B, and C. Category A contains items with MH D-DIF between -1 and +1 or MH D-DIF not significantly different from 0. Category B is assigned to items with MH D-DIF significantly different from 0, and an absolute value of at least 1, but not significantly greater than 1. Category C characterizes items with absolute value of MH D-DIF at least equal to 1.5, and

significantly greater than 1. Items with absolute values greater than 1.0 were selected for this study. This value was chosen in order to maximize the number of items that could be included in the investigation. Items for which the DIF was considered unchanged were those with values within .5 of the standard error.

Methodology. DIF analyses were performed using the Mantel-Haenszel procedures (Holland and Thayer, 1986) modified for use with test data. The Mantel-Haenszel estimate can be expressed by the following equation:

$$\hat{\alpha}_{MH} = \frac{(\Sigma A_i D_i / T_i)}{(\Sigma B_i C_i / T_i)}$$

where, for a given item j, the data from the ith level of reference and focal group members, where each level is defined by a score or range of scores on a suitable criterion measure, can be arranged as a 2×2 table:

Level i	Right on item j	Wrong on item j	
Reference	A_i	B_i	nR_i
Focal	C_i	D_i	nF_i
Total	R_i	W_i	T_i

for i=1,..., K = number of levels. A_i denotes the number of reference group members at the ith level who answered item j correctly. B_i , C_i , and D_i , have corresponding interpretations. nR_i and nF_i denote the number of reference and focal group members, respectively, at the ith level, while T_i denotes the total number of examinees at the ith level. R_i and W_i denote the number of examinees at the ith level who answer the item right and wrong, respectively. Considered together, these K 2×2 tables form one big 2×2×K table. There is one such table for each studied comparison. The methodology in this study consisted of performing DIF analyses on male, female, White, African American, Hispanic, and Asian American subgroups using the Mantel-Haenszel procedure where males and Whites served as reference groups for females and minority groups, respectively. These

analyses were performed on the Verbal and Quantitative sections of one test form of a graduate admission test administered in October 1990. Examinees were excluded from the analyses if they reported that they were not U.S. citizens or if they reported a language other than English as their best language. Prior to performing DIF analyses, distributions of self-reported undergraduate major field and number of courses in English and Mathematics were obtained for males, females, Whites, African Americans, Hispanics, and Asian Americans. These distributions enabled the determination of the adequate subgroup sample size[1] for meaningful analyses based on operational criteria such as the total test score for the Verbal and Quantitative test, respectively.

Frequency distributions were tabulated for reported undergraduate major and coursework in English and Mathematics for each subgroup separately. The educational variables selected, undergraduate major and coursework in English and Mathematics, were used based on the relevance to the test being analyzed. Examinees who reported that their undergraduate major was in an English-related field[2] were selected for the verbal analyses, if the sample size was acceptable. Examinees who reported that their undergraduate major was one of the Mathematics-related fields[3] were selected for the quantitative analyses. field and coursework in Mathematics were used to analyze Quantitative items.

For the coursework variable, the coursework in English and Mathematics was divided into three categories: no coursework (courses = 0), one to two courses, and over three courses. Although it may be expected that some students are better prepared because they have

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[1] Sample sizes over 100 were retained for this study. There were fewer than 100 American Indians regardless of the variable used; therefore, this subgroup was not used.

[2]English-related includes: Arts, English Language and Literature, Foreign Languages and Literature, History, Philosophy, Classics, Linguistics, Religious Studies, and Comparative Language and Literature.

[3]Mathematics-related includes: Agriculture, Biological Sciences, Chemistry, Computer and Information Sciences, Health and Medical Sciences, Earth, Atmospheric, and Marine Sciences, Mathematical Sciences, Physics and Astronomy, and Engineering.

taken more English coursework, this investigation compares only examinees who reported equivalent quantities of such courses. For each subgroup, means and standard deviations were calculated for the verbal and quantitative raw scores for the total number of examinees and for the English-related majors, Mathematics-related majors, and the three categories of coursework in English and Mathematics.

The comparisons performed in this study are summarized below:

Comparison	Criterion Score	Educational Variable
Male/Female	Verbal	Total group
White/African American	Verbal	Total group
White/Hispanic	Verbal	Total group
White/Asian American	Verbal	Total group
Male/Female	Verbal	English-related field
Male/Female	Verbal	English = 0 courses
Male/Female	Verbal	English = 1 to 2 courses
Male/Female	Verbal	English = 3 + courses
White/African American	Verbal	English-related field
White/African American	Verbal	English = 1 to 2 courses[4]
White/African American	Verbal	English = 3+ courses
White/Hispanic	Verbal	English-related field
White/Hispanic	Verbal	English = 1 to 2 courses
White/ Hispanic	Verbal	English = 3+ courses
White/Asian American	Verbal	English-related field
White/Asian American	Verbal	English = 1 to 2 courses
White/ Asian American	Verbal	English = 3+ courses
Male/Female	Quantitative	Total group
White/African American	Quantitative	Total group

[4] Sample sizes for the English = 0 courses for minority groups were too small to be included in the DIF analyses.

White/Hispanic	Quantitative	Total group
White/Asian American	Quantitative	Total group
Male/Female	Quantitative	Mathematics-related field
Male/Female	Quantitative	Mathematics = 0 courses
Male/Female	Quantitative	Mathematics = 1 to 2 courses
Male/Female	Quantitative	Mathematics = 3+ courses
White/African American	Quantitative	Mathematics-related group
White/African American	Quantitative	Mathematics = 1 to 2 courses[5]
White/African American	Quantitative	Mathematics = 3+ courses
White/Hispanic	Quantitative	Mathematics-related field
White/Hispanic	Quantitative	English = 1 to 2 Courses
White/Hispanic	Quantitative	English = 3+ Courses
White/Asian American	Quantitative	Mathematics-related field
White/Asian American	Quantitative	English = 1 to 2 courses
White/Asian American	Quantitative	English = 3+ courses

For the total group, all examinees were selected regardless of their undergraduate major and number of courses in English and Mathematics. The citizenship and English best language criteria were retained for the total group.

After DIF values were produced for the more homogeneous groups, the items were shown to experienced test developers who were asked for their hypotheses about the changes in DIF values. Each staff member has experience in developing Verbal or Quantitative test items, and the reviewers include members of the appropriate minority groups. At least two test developers reviewed each item.

[5] Sample sizes for the Mathematics = 0 courses for minority groups were too small to be included in the DIF analyses.

Results

Summary tables (Tables A, B, C, D) present the means, standard deviations, and sample sizes for the total groups and subgroups selected according to two educational variables. The remaining tables present summary DIF statistics, MH D-DIF values and standard errors of MH D-DIF, the classification any given item obtained (if any) in any given comparison. Item type is also listed. Male/Female comparisons for the Verbal criterion score are listed in Tables 1, 2, 3, and 4. White/African American comparisons for the Verbal criterion score are listed in Tables 5, 6, and 7. White/Hispanic comparisons for the Verbal criterion score are listed in Tables 8, 9, and 10. White/Asian American comparisons for the Verbal criterion score are listed in Tables 11, 12, and 13. Male/Female comparisons for the Quantitative criterion score are listed in tables 14, 15, 16, and 17. White/African American comparisons for the Quantitative score are listed in tables 18, 19, and 20. White/Hispanic comparisons for the Quantitative score are listed in tables 21, 22, and 23. White/Asian American comparisons for the Quantitative score are listed in tables 24, 25, and 26.

The total number of items flagged in the total group comparisons is shown in the table below and in Figure 1.

COMPARISON	VERBAL		QUANTITATIVE	
	DIF	%[6]	DIF	%
MALE/FEMALE	4	5	4	6
WHITE/AFRICAN-AMER.	7	9	6	10
WHITE/HISPANIC	5	7	6	10
WHITE/ASIAN-AMERICAN	9	12	8	13

A summary of the changes in Verbal DIF in relation to the total group is provided in the table below and in Figures 2, 3, 4, and 5. For the Male/Female Verbal comparisons, there

[6] Calculated as the percentage of the total number of items in the test.

were no increases in DIF for two comparisons and a major increase in DIF for one analysis (the English = 0 group). In all analyses analogy and antonym were flagged more than other item types. For the White/African American Verbal comparisons, the number of items with changed DIF values did not fall into a pattern. Antonyms and analogies had the largest changes in DIF although three of four Reading Comprehension items decreased in DIF for examinees conditioned on coursework in English and undergraduate major in English-related fields. For the White/Hispanic comparisons, more items with increased DIF were found in each of the analyses. Antonyms contributed the most to the increase in DIF. For the White/ Asian American comparison, two of the analyses showed increased DIF, one of which had a large number of items with increased DIF (12 items for English = 3+ courses). Analogies, sentence completion items, and antonyms, respectively, contributed the most to these changes.

COMPARISON	GROUP	DIF ⇑	%	DIF ⇓	%	DIF ≈	%
MALE/FEM	ENG-RELATED	3	4	3	4	1	1
MALE/FEM	ENG = 0	7	9	2	3	1	1
MALE/FEM	ENG= 1 TO 2	1	1	1	1	3	4
MALE/FEM	ENG = 3+	2	3	2	3	2	3
WHITE/AFR	ENG-RELATED	3	4	3	4	3	4
WHITE/AFR	ENG = 1 TO 2	2	3	4	5	3	4
WHITE/AFR	ENG = 3+	1	1	4	5	3	4
WHITE/HISP	ENG-RELATED	6	8	1	1	2	3
WHITE/HISP	ENG = 1 TO 2	6	8	2	3	1	1
WHITE/HISP	ENG = 3+	3	4	2	3	1	1
WHITE/ASIAN	ENG-RELATED	8	11	7	9	0	0
WHITE/ASIAN	ENG = 1 TO 2	4	5	7	9	2	3
WHITE/ASIAN	ENG = 3+	12	16	5	7	3	4

A summary of the changes in Quantitative DIF in relation to the total group is provided in the table below and in Figures 6, 7, 8, and 9. For the Male/Female comparisons, more items increased in DIF than decreased in DIF for the Math = 0 courses group and the Math = 1 to 2 courses group. Quantitative comparison items and data interpretation items were most responsible for the changes. For the White/African American comparisons, there was increased DIF in two of the three analyses; only the Math = 1 to 2 courses had fewer flagged items with the more homogeneous grouping. Items with changed DIF occurred in all three quantitative item types. For the White/Hispanic comparisons, only one analysis showed more DIF, the Mathematics-related majors. Data interpretation items contributed significantly to this result. For the White/Asian American comparisons, two analyses had more items for which the number of items with DIF decreased. Discrete quantitative items and data interpretation items were primarily responsible for these results.

COMPARISON	GROUP	DIF ⇑	%	DIF ⇓	%	DIF ≈	%
MALE/FEM	MATH-RELATED	3	5	3	5	2	3
MALE/FEM	MATH = 0	6	10	2	3	2	3
MALE/FEM	MATH = 1 TO 2	2	3	0	0	3	5
MALE/FEM	MATH = 3+	0	0	2	3	3	5
WHITE/AFR	MATH-RELATED	7	12	3	5	4	7
WHITE/AFR	MATH = 1 TO 2	3	5	5	8	2	3
WHITE/AFR	MATH = 3+	4	7	2	3	2	3
WHITE/HISP	MATH-RELATED	5	8	1	2	4	7
WHITE/HISP	MATH = 1 TO 2	2	3	3	5	2	3
WHITE/HISP	MATH = 3+	3	5	4	7	2	3
WHITE/ASIAN	MATH-RELATED	4	7	3	5	5	8
WHITE/ASIAN	MATH = 1 TO 2	3	5	7	12	2	3
WHITE/ASIAN	MATH = 3+	3	5	5	8	4	7

Conclusions

Although this study was begun with the idea that a more homogeneous population might decrease the number of items with DIF, the research did not entirely support the original hypothesis. In many cases, the number of items with DIF remained the same or increased when a more homogeneous population was analyzed. Some of these findings are no doubt due to the clustering of people by major field and by courses reported. Because the sample sizes were low, it was not possible to analyze only English majors or Mathematics majors. In an effort to obtain sufficient data, additional majors were added, but these fields vary in the kinds of verbal or quantitative skills that are required. Thus, the results for quantitative items are based on mathematics and science fields. The researchers recognize that some of the science fields are less quantitatively oriented than others. Nevertheless, it is a reasonable assumption that students in science fields have more familiarity with quantitative concepts and processes than social science or humanities fields. Since the mathematics upon which the quantitative reasoning questions are based are contained in high school algebra and geometry courses, it was felt that clustering the mathematics and science courses would permit data to be gathered with an acceptable amount of variation within the mathematics-related group. A similar procedure was followed for the English-related group since the fields that were clustered all require some (albeit varying) levels of verbal facility.

The coursework analyses were also not as clear has had been expected. Since examinees were pooled into groups of 0 courses, 1-2 courses, and 3+ courses, these groups may contain students with very different kinds of backgrounds. For example, students who report 1-2 mathematics courses may be students who are fulfilling a college or university requirement. However, this same group may also contain non-majors taking a course for fun or students who are required to take remedial courses before they are permitted to take other college courses.

Even with these anomalies, there were some findings that appear worthy of note. One result is that the increased number of items in most of the comparisons did not appear in all areas of the test specifications. In the Verbal measure, very few reading comprehension

items appeared; most of the items with increased DIF were analogy, antonym, or sentence completion items. In the Quantitative measure, all item types were affected about equally.

Efforts to explain the changes in DIF were partially successful. For some items, it was relatively easy to link decreased DIF to an increased verbal or quantitative fluency. However, not all items that might have been expected to show decreased DIF did so. In each reference/focal group analysis, a small number of items maintained a relatively steady DIF level.

Even more surprising than the number of items that retained a steady DIF level were those analyses for which the number of items with DIF increased. For 7 of the 13 verbal analyses and for 6 of the 13 quantitative analyses, there were fewer items with DIF for the total group than there were for the more homogeneous group. (For 4 verbal analyses and for 1 quantitative analysis, there was no change in the number of items with DIF.) The problems in clustering may account for some of these results.

There were some similarities in the increased DIF items for some comparisons. For the Hispanic/White analyses by major, five of the six items with increased DIF seemed to be related to cognates: a true cognate showed larger positive DIF; items with false or no cognates showed larger negative DIF. In the quantitative measure, the Black/White analyses by major flagged six items that became more positive and two that became more negative. The six positive items seem to be related to the content areas of algebra and number theory. Despite these findings, it was not possible to find common elements for many of the analyses.

On the whole, this study was hampered by the fact that only one test form was available and the sample sizes on this test form did not permit the preferred method of clustering examinees. Nonetheless, some of the DIF did appear to be explainable, and the contribution of background variables to the explanation of DIF may yet prove worthwhile. To the extent that information from this research that elucidates the interaction between

gender/ethnicity and education helped to make high DIF values for some items easier to explicate, the study may help shape a direction for further investigation.

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Table A
Summary Statistics Across Comparisons for Verbal Test
Total Group and English-Related Majors[1]

SUMMARY STATISTICS	TOTAL GROUP					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	4282	6419	9267	416	368	341
MEAN	47.01	43.86	47.34	36.00	39.98	47.14
ST. DEV.	10.13	10.29	10.20	10.60	11.55	11.53
SUMMARY STATISTICS	**ENGLISH-RELATED MAJORS**					
	MALE	**FEMALE**	**WHITE**	**AFRICAN AMERICAN**	**HISPANIC**	**ASIAN AMERICAN**
N	1534	2532	3557	154	124	102
MEAN	51.06	49.02	51.24	39.52	41.77	50.99
ST. DEV.	10.69	10.69	10.42	11.23	12.12	11.46

[1] English-related majors include: Arts, English Language and Literature, Foreign Languages and Literature, History, Philosophy, Classics, Linguistics, Religious Studies, and Comparative Language and Literature.

Table B
Summary Statistics Across Comparisons for Verbal Test
Total Group and Coursework in English

SUMMARY STATISTICS	TOTAL GROUP					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	4282	6419	9267	416	368	341
MEAN	47.01	43.86	47.34	36.00	39.98	47.14
ST. DEV.	10.13	10.29	10.20	10.60	11.55	11.53
SUMMARY STATISTICS	**ENGLISH = 0 COURSES**					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	286	211	N/A	N/A	N/A	N/A
MEAN	52.79	49.90	N/A	N/A	N/A	N/A
ST. DEV.	9.70	10.43	N/A	N/A	N/A	N/A
SUMMARY STATISTICS	**ENGLISH = 1 TO 2 COURSES**					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	2826	3579	5455	260	198	300
MEAN	46.85	43.85	47.23	37.07	40.84	48.12
ST. DEV.	10.07	9.93	10.05	10.60	10.73	10.80
SUMMARY STATISTICS	**ENGLISH = 3+ COURSES**					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	4057	6948	9390	583	422	270
MEAN	46.06	43.63	46.18	34.57	39.32	44.03
ST. DEV.	10.67	10.54	10.33	10.58	11.04	12.83

Table C
Summary Statistics Across Comparisons for Quantitative Test
Total Group and Mathematics-Related Majors[5]

SUMMARY STATISTICS	TOTAL GROUP					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	4281	6419	9267	416	368	341
MEAN	39.69	32.01	34.06	23.70	30.43	40.35
ST. DEV.	11.46	10.23	10.79	10.09	11.57	9.84
SUMMARY STATISTICS	**MATHEMATICS-RELATED MAJORS**					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	3207	2999	5232	239	224	326
MEAN	44.92	35.36	39.06	27.96	36.02	44.62
ST. DEV.	9.93	10.99	11.09	11.07	10.93	9.66

[5] Mathematics-related majors include: Agriculture, Biological Sciences, Chemistry, Computer and Information Sciences, Health and Medical Sciences, Earth, Atmospheric, and Marine Sciences, Mathematical Sciences, Physics and Astronomy, and Engineering.

Table D
Summary Statistics Across Comparisons for Quantitative Test
Total Group and Coursework in Mathematics

SUMMARY STATISTICS	TOTAL GROUP					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	4281	6419	9267	416	368	341
MEAN	39.69	32.01	34.06	23.70	30.43	40.35
ST. DEV.	11.46	10.23	10.79	10.09	11.57	9.84
SUMMARY STATISTICS	**MATHEMATICS = 0 COURSES**					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	552	1356	N/A	N/A	N/A	N/A
MEAN	34.79	31.05	N/A	N/A	N/A	N/A
ST. DEV.	10.54	9.36	N/A	N/A	N/A	N/A
SUMMARY STATISTICS	**MATHEMATICS = 1 TO 2 COURSES**					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	2551	5699	7178	388	255	208
MEAN	34.59	30.59	31.27	20.74	26.70	35.64
ST. DEV.	10.73	9.68	9.68	8.65	9.64	9.81
SUMMARY STATISTICS	**MATHEMATICS = 3+ COURSES**					
	MALE	FEMALE	WHITE	AFRICAN AMERICAN	HISPANIC	ASIAN AMERICAN
N	4022	3535	6206	401	330	351
MEAN	42.91	33.82	37.83	25.47	33.47	43.17
ST. DEV.	10.78	11.16	11.30	10.19	11.42	9.60

Table 1
DIF Statistics for Verbal Test
Total Group and English-Related Majors

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.12 (B)	0.20	-0.40	0.32
ANALOGY	-1.04 (B)	0.11	-0.69	0.19
ANALOGY	1.77 (C)	0.14	0.94	0.28
ANALOGY	2.02 (C)	0.11	2.22 (C)	0.19
ANALOGY	0.56	0.10	1.02 (B)	0.18
ANTONYM	-0.65	0.11	-1.12 (B)	0.17
ANTONYM	0.73	0.11	1.14 (B)	0.17

Table 2
DIF Statistics for Verbal Test[2]
Total Group and English = 0[3]

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 0	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
ANALOGY	-1.12 (B)	0.20	-1.84 (B)	1.18
SENTENCE COMPLETION	0.72	0.10	1.13 (B)	0.52
ANALOGY	-1.04 (B)	0.11	-0.48	0.61
ANALOGY	1.77 (C)	0.14	1.03	0.69
ANALOGY	2.02 (C)	0.11	2.05 (C)	0.56
ANTONYM	0.11	0.13	1.92 (B)	0.87
ANTONYM	0.27	0.10	1.13 (B)	0.48
ANALOGY	-0.91	0.12	-1.78 (B)	0.65
ANALOGY	0.31	0.11	1.19 (B)	0.48
READING COMPREHENSION	0.72	0.11	1.27 (B)	0.49

[2] White/African American, White/Asian American, and White/Hispanic comparisons were not analyzed due to insufficient sample sizes.

[3] This group includes examinees who indicated no coursework in English on the GRE Descriptive Questionnaire.

Table 3
DIF Statistics for Verbal Test
Total Group and English = 1 to 2 Courses[4]

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.12 (B)	0.20	-1.14 (B)	0.25
ANALOGY	-1.04 (B)	0.11	-1.04 (B)	0.15
ANALOGY	1.77 (C)	0.14	1.71 (C)	0.17
ANALOGY	2.02 (C)	0.11	1.85 (C)	0.14
ANALOGY	-0.91	0.12	-1.27 (B)	0.16

Table 4
DIF Statistics for Verbal Test
Total Group and English = 3+

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
ANALOGY	-1.12 (B)	0.20	-0.85	0.18
ANALOGY	-1.04 (B)	0.11	-0.97	0.11
ANALOGY	1.77 (C)	0.14	1.61 (C)	0.14
ANALOGY	2.02 (C)	0.11	1.96 (C)	0.11
ANALOGY	-0.93	0.13	-1.02 (B)	0.12
SENTENCE COMPLETION	-0.96	0.29	-1.12 (B)	0.29

[4] This group includes examinees who indicated taking one to two courses in English on the GRE Descriptive Questionnaire.

Table 5
DIF Statistics for Verbal Test
Total Group and English-Related Majors

White/African American Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-0.66	0.26	-1.31 (B)	0.42
READING COMPREHENSION	1.16 (B)	0.31	1.27 (B)	0.48
READING COMPREHENSION	1.00 (B)	0.28	0.64	0.47
ANTONYM	-1.20 (B)	0.28	-1.72 (B)	0.46
ANALOGY	-1.16 (B)	0.27	-1.29 (B)	0.46
READING COMPREHENSION	1.01 (B)	0.28	0.59	0.46
READING COMPREHENSION	-1.10 (B)	0.28	-0.67	0.45
ANTONYM	1.27 (B)	0.34	1.15 (B)	0.56
ANTONYM	0.28	0.31	1.32 (B)	0.59

Table 6
DIF Statistics for Verbal Test
Total Group and English = 1 to 2 Courses

White/African American Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
ANALOGY	-0.68	0.26	-1.20 (B)	0.33
READING COMPREHENSION	1.16 (B)	0.31	1.30 (B)	0.39
READING COMPREHENSION	1.00 (B)	0.28	0.76	0.35
ANTONYM	-1.20 (B)	0.28	-1.55 (B)	0.35
ANALOGY	-1.16 (B)	0.27	-0.38	0.35
ANALOGY	-0.89	0.38	-1.03 (B)	0.48
READING COMPREHENSION	1.01 (B)	0.28	-0.27	0.39
READING COMPREHENSION	-1.10 (B)	0.28	-0.67	0.35
ANTONYM	1.27 (B)	0.34	1.53 (B)	0.42

Table 7
DIF Statistics for Verbal Test
Total Group and English = 3+ Courses

White/African American Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
READING COMPREHENSION	1.16(B)	0.31	1.13 (B)	0.27
READING COMPREHENSION	1.00 (B)	0.28	0.73	0.24
ANTONYM	-1.20 (B)	0.28	-1.13 (B)	0.24
ANTONYM	-0.63	0.29	-1.01 (B)	0.25
ANALOGY	-1.16 (B)	0.27	-1.28 (B)	0.23
READING COMPREHENSION	1.01 (B)	0.28	0.81	0.24
READING COMPREHENSION	-1.10 (B)	0.28	-0.79	0.24
ANTONYM	1.27 (B)	0.34	1.54 (C)	0.30

Table 8
DIF Statistics for Verbal Test
Total Group and English-Related Majors

White/Hispanic Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.50 (B)	0.36	-1.32 (B)	0.69
SENTENCE COMPLETION	-0.48	0.35	-1.64 (B)	0.59
ANALOGY	-1.49 (B)	0.30	-2.22 (C)	0.56
ANALOGY	-0.53	0.28	-1.04 (B)	0.51
ANTONYM	-2.05 (C)	0.40	-2.34 (C)	0.74
SENTENCE COMPLETION	-0.46	0.31	-1.13 (B)	0.58
ANALOGY	-1.03 (B)	0.29	-1.40 (B)	0.51
ANTONYM	1.03 (B)	0.30	0.56	0.53
ANTONYM	0.34	0.26	1.20 (B)	0.49

Table 9
DIF Statistics for Verbal Test
Total Group and English = 1 to 2 Courses

White/Hispanic Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.50 (B)	0.36	-0.58 (B)	0.55
ANALOGY	-1.49 (B)	0.30	-1.72 (C)	0.41
ANTONYM	-2.05 (C)	0.40	-1.19 (C)	0.61
ANTONYM	0.63	0.34	1.09 (B)	0.52
ANTONYM	-0.43	0.31	-1.12 (B)	0.42
ANTONYM	-0.71	0.29	-1.16 (B)	0.40
ANALOGY	-1.03 (B)	0.29	-0.84	0.40
ANTONYM	0.55	0.34	1.28 (B)	0.50
ANTONYM	1.03 (B)	0.30	1.15 (B)	0.40

Table 10
DIF Statistics for Verbal Test
Total Group and English = 3+ Courses

White/Hispanic Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.50 (B)	0.36	-1.29 (B)	0.32
ANALOGY	-1.49 (B)	0.30	-1.48 (B)	0.28
ANTONYM	-2.05 (C)	0.40	-1.63 (C)	0.37
ANTONYM	0.65	0.31	1.05 (B)	0.29
ANALOGY	-1.03	0.29	-0.86	0.27
ANTONYM	1.03 (B)	0.30	0.74	0.28

Table 11
DIF Statistics for Verbal Test
Total Group and English-Related Majors

White/Asian American Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.67 (B)	0.71	-0.08	1.71
ANALOGY	-0.84	0.31	-1.40 (B)	0.57
ANALOGY	0.32	0.29	1.49 (B)	0.54
READING COMPREHENSION	0.62	0.29	1.29 (B)	0.55
SENTENCE COMPLETION	-1.36 (B)	0.62	0.98	2.17
SENTENCE COMPLETION	-1.09 (B)	0.35	-1.52 (B)	0.70
ANALOGY	1.06 (B)	0.47	0.09	0.76
ANALOGY	1.01 (B)	0.40	-0.68	0.66
ANALOGY	-0.66	0.32	-1.02 (B)	0.60
ANALOGY	-0.85	0.32	-1.58 (B)	0.55
ANALOGY	1.20 (B)	0.28	0.66	0.52
ANTONYM	1.72 (B)	0.56	2.39 (B)	1.32
ANTONYM	-1.87 (C)	0.33	-1.41 (B)	0.72
ANTONYM	0.18	0.39	1.83 (B)	1.03
ANTONYM	1.04 (B)	0.28	0.79	0.50

Table 12
DIF Statistics for Verbal Test
Total Group and English = 1 to 2 Courses

White/Asian American Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.67 (B)	0.71	-0.99	0.93
SENTENCE COMPLETION	-0.76	0.47	-1.07 (B)	0.51
ANALOGY	-0.84	0.31	-1.20 (B)	0.33
READING COMPREHENSION	0.15	0.30	1.01 (B)	0.32
ANTONYM	0.97	0.46	1.34 (B)	0.54
SENTENCE COMPLETION	-1.36 (B)	0.62	-1.20 (B)	0.71
SENTENCE COMPLETION	-1.09 (B)	0.35	-1.22 (B)	0.37
ANALOGY	1.06 (B)	0.47	0.74	0.50
ANALOGY	1.01 (B)	0.40	0.83	0.44
ANALOGY	1.20 (B)	0.28	0.73	0.30
ANTONYM	1.72 (B)	0.56	1.38 (B)	0.61
ANTONYM	-1.87 (C)	0.33	-1.22 (B)	0.36
ANTONYM	1.04 (B)	0.28	0.61	0.31

Table 13
DIF Statistics for Verbal Test
Total Group and English = 3+ Courses

White/Asian American Comparison

ITEM TYPE	TOTAL GROUP		ENGLISH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
SENTENCE COMPLETION	-1.67 (B)	0.71	-1.79 (B)	0.70
SENTENCE COMPLETION	-0.76	0.47	-1.29 (B)	0.44
SENTENCE COMPLETION	0.56	0.39	1.04 (B)	0.42
SENTENCE COMPLETION	-0.82	0.41	-1.18 (B)	0.41
ANALOGY	-0.82	0.37	-1.17 (B)	0.39
ANALOGY	-0.84	0.31	-1.06 (B)	0.36
READING COMPREHENSION	-0.83	0.31	-1.23 (B)	0.34
ANTONYM	0.97	0.46	1.15 (B)	0.49
SENTENCE COMPLETION	-1.36 (B)	0.62	0.11	0.77
SENTENCE COMPLETION	-1.09 (B)	0.35	-1.25 (B)	0.39
ANALOGY	1.06 (B)	0.47	0.72	0.48
ANALOGY	1.01 (B)	0.40	-0.09	0.38
ANALOGY	-0.85	0.32	-1.15 (B)	0.34
ANALOGY	1.20 (B)	0.28	0.99	0.32
READING COMPREHENSION	-0.01	0.27	-1.15 (B)	0.33
ANTONYM	-1.33	0.74	-1.82 (B)	0.70
ANTONYM	1.72	0.56	1.45 (B)	0.56
ANTONYM	-1.87 (C)	0.33	-2.09 (C)	0.36
ANTONYM	0.19	0.30	1.15 (B)	0.36
ANTONYM	1.04 (B)	0.28	0.92	0.32

Table 14
DIF Statistics for Quantitative Test
Total Group and Mathematics-Related Majors

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		MATH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
DISCRETE QUANTITATIVE	-1.03 (B)	0.19	-0.42	0.29
DATA INTERPRETATION	0.39	0.16	1.09 (B)	0.23
QUANTITATIVE COMPARISON	1.09 (B)	0.14	0.71	0.20
QUANTITATIVE COMPARISON	0.15	0.13	-1.02 (B)	0.21
QUANTITATIVE COMPARISON	-0.72	0.11	-1.04 (B)	0.15
DATA INTERPRETATION	-1.05 (B)	0.11	-1.22 (B)	0.17
DATA INTERPRETATION	-1.17 (B)	0.11	-0.75	0.15

Table 15
DIF Statistics for Quantitative Test[6]
Total Group and Mathematics = 0[7]

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		MATH = 0	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	1.00	0.13	1.32 (B)	0.29
QUANTITATIVE COMPARISON	-0.76	0.11	-1.01 (B)	0.26
QUANTITATIVE COMPARISON	0.69	0.12	1.13 (B)	0.33
DISCRETE QUANTITATIVE	-1.03 (B)	0.19	-0.14	0.44
DATA INTERPRETATION	-0.19	0.15	-1.06 (B)	0.39
DISCRETE QUANTITATIVE	0.46	0.14	1.00 (B)	0.35
QUANTITATIVE COMPARISON	0.80	0.15	1.02 (B)	0.33
QUANTITATIVE COMPARISON	1.09 (B)	0.14	1.09 (B)	0.31
DATA INTERPRETATION	-1.05 (B)	0.11	-1.24 (B)	0.27
DATA INTERPRETATION	-1.17 (B)	0.11	-1.17 (B)	0.27

[6] White/African American, White/Asian American, and White/Hispanic comparisons were not analyzed due to insufficient sample sizes.

[7] This group includes examinees who indicated no coursework in English on the GRE Descriptive Questionnaire.

Table 16
DIF Statistics for Quantitative Test
Total Group and Mathematics = 1 to 2 Courses[8]

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		MATH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	1.00	0.13	1.01 (B)	0.14
DISCRETE QUANTITATIVE	-1.03 (B)	0.19	-0.96	0.20
QUANTITATIVE COMPARISON	1.09 (B)	0.14	0.98	0.15
DATA INTERPRETATION	-1.05 (B)	0.11	-1.44 (B)	0.13
DATA INTERPRETATION	-1.17 (B)	0.11	-1.35 (B)	0.13

Table 17
DIF Statistics for Quantitative Test
Total Group and Mathematics = 3+ Courses[9]

Male/Female Comparison

ITEM TYPE	TOTAL GROUP		MATH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	-1.00	0.15	-1.06 (B)	0.17
DISCRETE QUANTITATIVE	-1.03 (B)	0.19	-0.47	0.22
QUANTITATIVE COMPARISON	1.09 (B)	0.14	1.15 (B)	0.18
DATA INTERPRETATION	-1.05 (B)	0.11	-0.88	0.13
DATA INTERPRETATION	-1.17 (B)	0.11	-1.06	0.13

[8] This group includes examinees who indicated taking one to two courses in English on the GRE Descriptive Questionnaire.

[9] This group indicated taking more than three courses in English on the GRE Descriptive Questionnaire.

Table 18
DIF Statistics for Quantitative Test
Total Group and Mathematics-Related Majors

White/African American Comparison

ITEM TYPE	TOTAL GROUP		MATH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	0.47	0.30	1.03 (B)	0.36
DISCRETE QUANTITATIVE	-2.31 (C)	0.29	-2.33 (C)	0.43
DISCRETE QUANTITATIVE	1.19 (B)	0.29	1.15 (B)	0.41
DISCRETE QUANTITATIVE	-0.84	0.30	-1.47 (B)	0.44
DATA INTERPRETATION	-0.96	0.30	-1.02 (B)	0.41
DISCRETE QUANTITATIVE	-0.62	0.41	-1.12 (B)	0.52
QUANTITATIVE COMPARISON	1.04 (B)	0.32	2.34 (C)	0.55
QUANTITATIVE COMPARISON	0.81	0.29	1.24 (B)	0.43
QUANTITATIVE COMPARISON	0.39	0.32	1.19 (B)	0.42
DISCRETE QUANTITATIVE	0.40	0.28	1.04 (B)	0.36
DATA INTERPRETATION	-1.74 (C)	0.28	-1.63 (B)	0.41
DATA INTERPRETATION	-1.35 (B)	0.27	-1.07 (B)	0.39
DATA INTERPRETATION	-1.50 (B)	0.31	-1.08 (B)	0.38
DISCRETE QUANTITATIVE	0.97	0.30	1.56 (B)	0.38

Table 19
DIF Statistics for Quantitative Test
Total Group and Mathematics = 1 to 2 Courses

White/African American Comparison

ITEM TYPE	TOTAL GROUP		MATH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	-0.24	0.29	-1.01 (B)	0.28
DISCRETE QUANTITATIVE	-2.31 (C)	0.29	-1.78 (C)	0.30
DISCRETE QUANTITATIVE	1.19 (B)	0.29	0.97	0.30
DATA INTERPRETATION	-0.96	0.30	-1.24 (B)	0.31
QUANTITATIVE COMPARISON	1.04 (B)	0.32	-0.06	0.32
QUANTITATIVE COMPARISON	0.39	0.32	1.03 (B)	0.33
DATA INTERPRETATION	-1.74 (C)	0.28	-1.69 (C)	0.29
DATA INTERPRETATION	-1.35 (B)	0.27	-0.54	0.29
DATA INTERPRETATION	-1.50 (B)	0.31	-1.00	0.33
DISCRETE QUANTITATIVE	0.97	0.30	1.06 (B)	0.31

Table 20
DIF Statistics for Quantitative Test
Total Group and Mathematics = 3+ Courses

White/African American Comparison

ITEM TYPE	TOTAL GROUP		MATH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
DISCRETE QUANTITATIVE	-2.31 (C)	0.29	-2.36 (C)	0.32
DISCRETE QUANTITATIVE	1.19 (B)	0.29	0.72	0.30
DISCRETE QUANTITATIVE	-0.84	0.30	-1.10 (B)	0.33
DATA INTERPRETATION	-0.96	0.30	-1.16 (B)	0.31
QUANTITATIVE COMPARISON	1.04 (B)	0.32	1.25 (B)	0.37
DATA INTERPRETATION	-1.74 (C)	0.28	-1.93 (B)	0.31
DATA INTERPRETATION	-1.35 (B)	0.27	-1.12	0.29
DATA INTERPRETATION	-1.50 (B)	0.31	-1.40 (B)	0.31

Table 21
DIF Statistics for Quantitative Test
Total Group and Mathematics-Related Majors

White/Hispanic Comparison

ITEM TYPE	TOTAL GROUP		MATH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	0.41	0.32	1.23 (B)	0.50
DISCRETE QUANTITATIVE	-1.19 (B)	0.35	-1.33 (B)	0.55
DATA INTERPRETATION	-1.24 (B)	0.33	-1.39 (B)	0.47
DATA INTERPRETATION	-1.04 (B)	0.32	-1.44 (B)	0.44
QUANTITATIVE COMPARISON	0.93	0.36	1.94 (B)	0.72
QUANTITATIVE COMPARISON	1.20 (B)	0.32	0.55	0.49
DISCRETE QUANTITATIVE	-0.35	0.30	-1.17 (B)	0.39
DATA INTERPRETATION	-1.27 (B)	0.33	-1.98 (C)	0.47
DISCRETE QUANTITATIVE	1.17 (B)	0.29	1.21 (B)	0.48
DISCRETE QUANTITATIVE	0.92	0.35	1.06 (B)	0.41

Table 22
DIF Statistics for Quantitative Test
Total Group and Mathematics = 1 to 2 Courses

White/Hispanic Comparison

ITEM TYPE	TOTAL GROUP		MATH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
DISCRETE QUANTITATIVE	-1.19 (B)	0.35	-1.20 (B)	0.39
DATA INTERPRETATION	-1.24 (B)	0.33	-1.26 (B)	0.38
DATA INTERPRETATION	-1.04 (B)	0.32	-0.63	0.37
QUANTITATIVE COMPARISON	1.20 (B)	0.32	0.40	0.35
DATA INTERPRETATION	-1.27 (B)	0.33	-1.51 (B)	0.37
DISCRETE QUANTITATIVE	1.17 (B)	0.29	0.33	0.36
DISCRETE QUANTITATIVE	0.60	0.41	-1.94 (B)	0.80

Table 23
DIF Statistics for Quantitative Test
Total Group and Mathematics = 3+ Courses

White/Hispanic Comparison

ITEM TYPE	TOTAL GROUP		MATH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	0.41	0.32	1.05 (B)	0.45
DISCRETE QUANTITATIVE	-1.19 (B)	0.35	-0.53	0.42
DATA INTERPRETATION	-1.24 (B)	0.33	-1.57 (B)	0.35
DATA INTERPRETATION	-1.04 (B)	0.32	-1.11 (B)	0.35
QUANTITATIVE COMPARISON	0.93	0.36	1.40 (B)	0.47
QUANTITATIVE COMPARISON	1.20 (B)	0.32	0.95	0.38
DATA INTERPRETATION	-1.27 (B)	0.33	-0.94	0.38
DATA INTERPRETATION	-0.86	0.29	-1.02 (B)	0.30
DISCREETE QUANTITATIVE	1.17 (B)	0.29	0.67	0.31

Table 24
DIF Statistics for Quantitative Test
Total Group and Mathematics-Related Majors

White/Asian American Comparison

ITEM TYPE	TOTAL GROUP		MATH-RELATED	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	1.23 (B)	0.46	0.32	0.54
DISCRETE QUANTITATIVE	-2.69 (C)	0.48	-3.29 (C)	0.56
DATA INTERPRETATION	-1.33 (B)	0.58	-1.42 (B)	0.77
DATA INTERPRETATION	-2.40 (C)	0.42	-3.00 (C)	0.44
QUANTITATIVE COMPARISON	0.63	0.60	2.54 (B)	1.12
QUANTITATIVE COMPARISON	0.47	0.32	1.33 (B)	0.36
DATA INTERPRETATION	-1.80 (C)	0.47	-1.92 (C)	0.53
DATA INTERPRETATION	-0.89	0.34	-1.12 (B)	0.38
DATA INTERPRETATION	-1.05 (B)	0.31	-1.19 (B)	0.34
DISCRETE QUANTITATIVE	1.65 (C)	0.36	1.20 (B)	0.41
DISCRETE QUANTITATIVE	1.45 (B)	0.32	1.29 (B)	0.34
DISCRETE QUANTITATIVE	1.60 (C)	0.34	1.23 (B)	0.35

Table 25
DIF Statistics for Quantitative Test
Total Group and Mathematics = 1 to 2 Courses

White/Asian American Comparison

ITEM TYPE	TOTAL GROUP		MATH = 1 TO 2	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	1.23 (B)	0.46	1.22 B	0.45
DISCRETE QUANTITATIVE	-2.69 (C)	0.48	-2.37 (C)	0.53
DATA INTERPRETATION	-1.33 (B)	0.58	-0.70	0.66
DATA INTERPRETATION	-2.40 (C)	0.42	-1.86 (C)	0.50
DATA INTERPRETATION	-0.65	0.30	-1.30 (B)	0.36
QUANTITATIVE COMPARISON	0.63	0.60	1.57 (B)	0.66
QUANTITATIVE COMPARISON	0.75	0.44	1.40 (B)	0.50
DATA INTERPRETATION	-1.80	0.47	-1.19 (B)	0.51
DATA INTERPRETATION	-1.05	0.31	-1.05 (B)	0.36
DISCRETE QUANTITATIVE	1.65 (C)	0.36	1.19 (B)	0.39
DISCRETE QUANTITATIVE	1.45 (B)	0.32	0.37	0.42
DISCRETE QUANTITATIVE	1.60 (C)	0.34	0.76	0.45

Table 26
DIF Statistics for Quantitative Test
Total Group and Mathematics = 3+ Courses

White/Asian American Comparison

ITEM TYPE	TOTAL GROUP		MATH = 3+	
	MH D-DIF	STD ERR	MH D-DIF	STD ERR
QUANTITATIVE COMPARISON	1.23	0.46	0.30	0.53
DISCRETE QUANTITATIVE	-2.69 (C)	0.48	-2.67 (C)	0.52
DATA INTERPRETATION	-1.33 (B)	0.58	-0.37	0.70
DATA INTERPRETATION	-2.40 (C)	0.42	-2.75 (C)	0.42
QUANTITATIVE COMPARISON	0.75	0.44	1.33 (B)	0.59
QUANTITATIVE COMPARISON	0.47	0.32	1.27 (B)	0.34
DATA INTERPRETATION	-1.80 (C)	0.47	-1.98 (C)	0.47
DATA INTERPRETATION	-0.89	0.34	-1.01 (B)	0.37
DATA INTERPRETATION	-1.05 (B)	0.31	-1.02 (B)	0.32
DISCRETE QUANTITATIVE	1.65 (C)	0.36	1.13 (B)	0.38
DISCRETE QUANTITATIVE	1.45 (B)	0.32	1.20 (B)	0.32
DISCRETE QUANTITATIVE	1.60 (C)	0.34	1.26 (B)	0.33

Figure 1

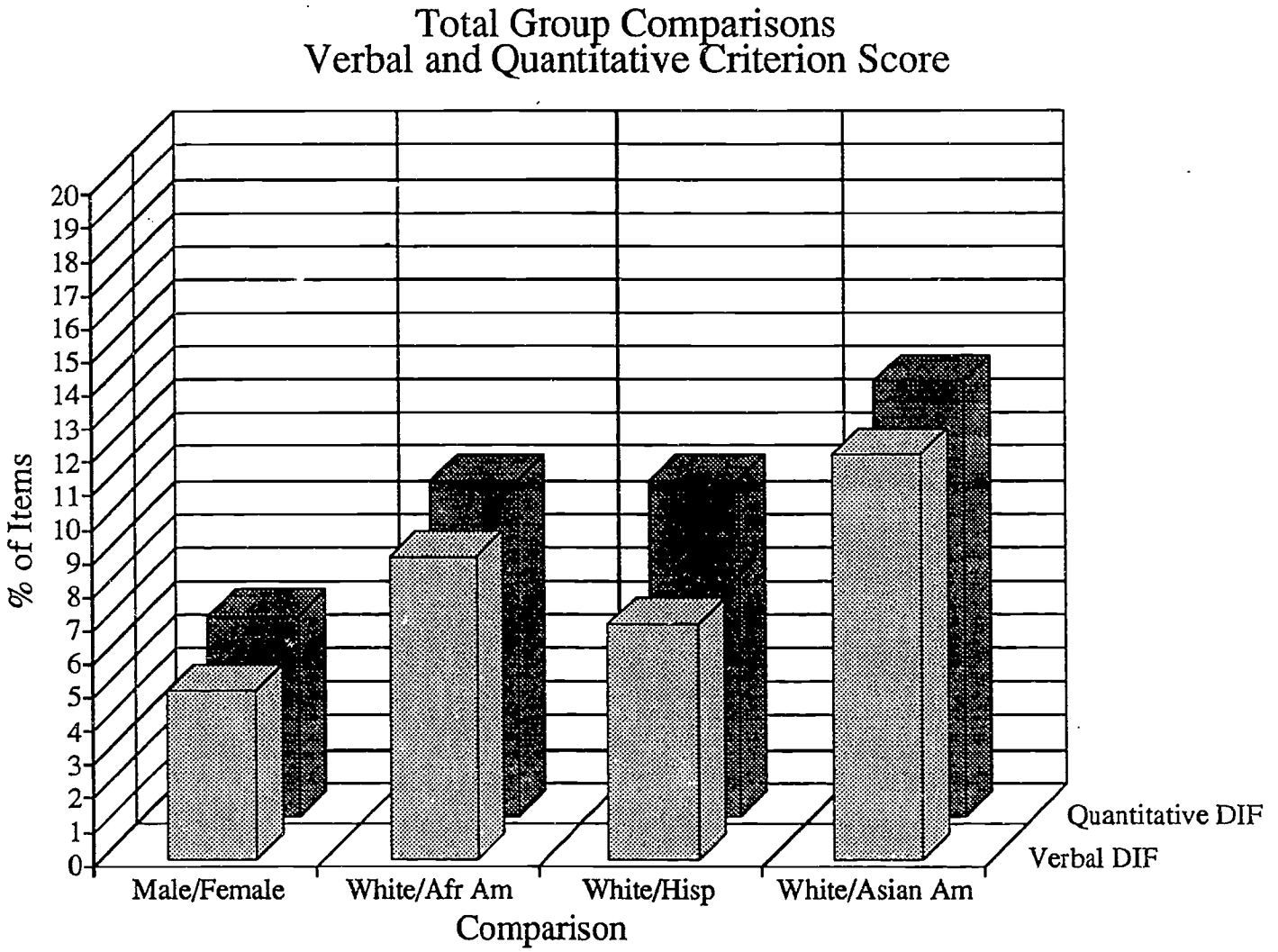
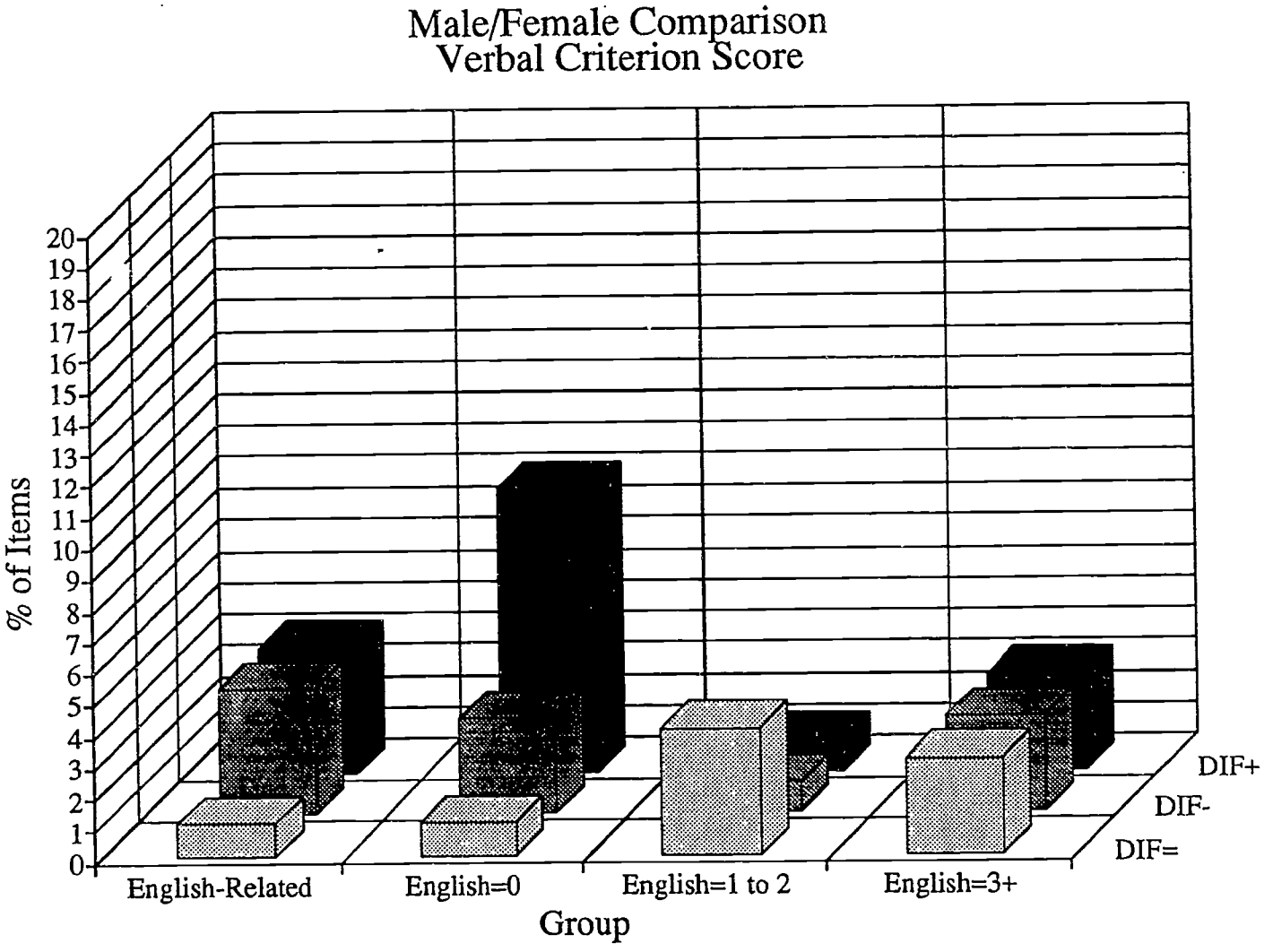

Total Group Comparisons
Verbal and Quantitative Criterion Score
% of Items
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Male/Female
White/Afr Am
White/Hisp
White/Asian Am
Comparison
Quantitative DIF
Verbal DIF

Figure 2



Note: DIF+ corresponds to DIF⇑, DIF- corresponds to DIF⇓, and DIF= corresponds to DIF≈ in summary tables.

Figure 3

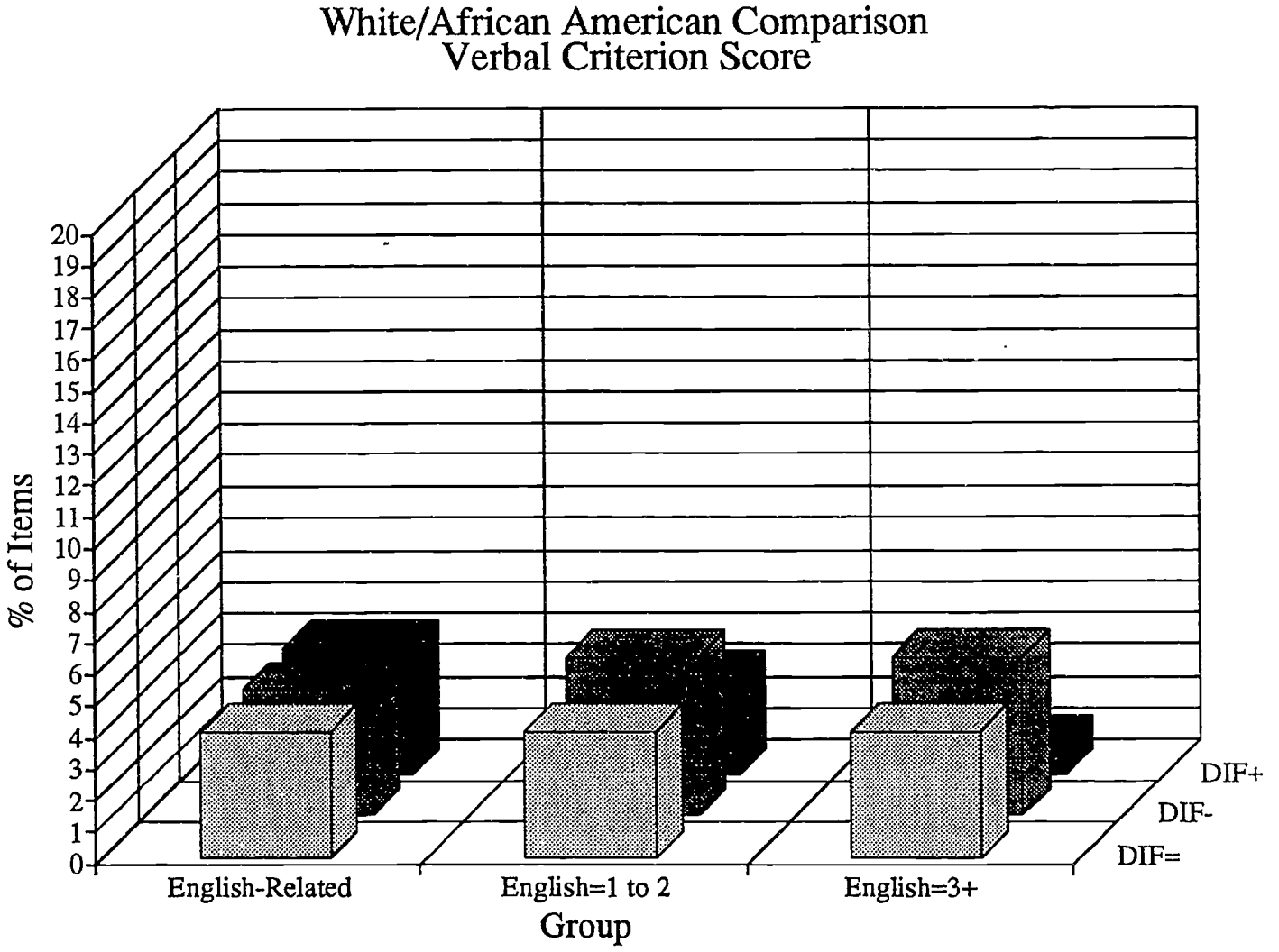

White/African American Comparison
Verbal Criterion Score
% of Items
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
English-Related
English=1 to 2
English=3+
Group
DIF+
DIF-
DIF=

Figure 4

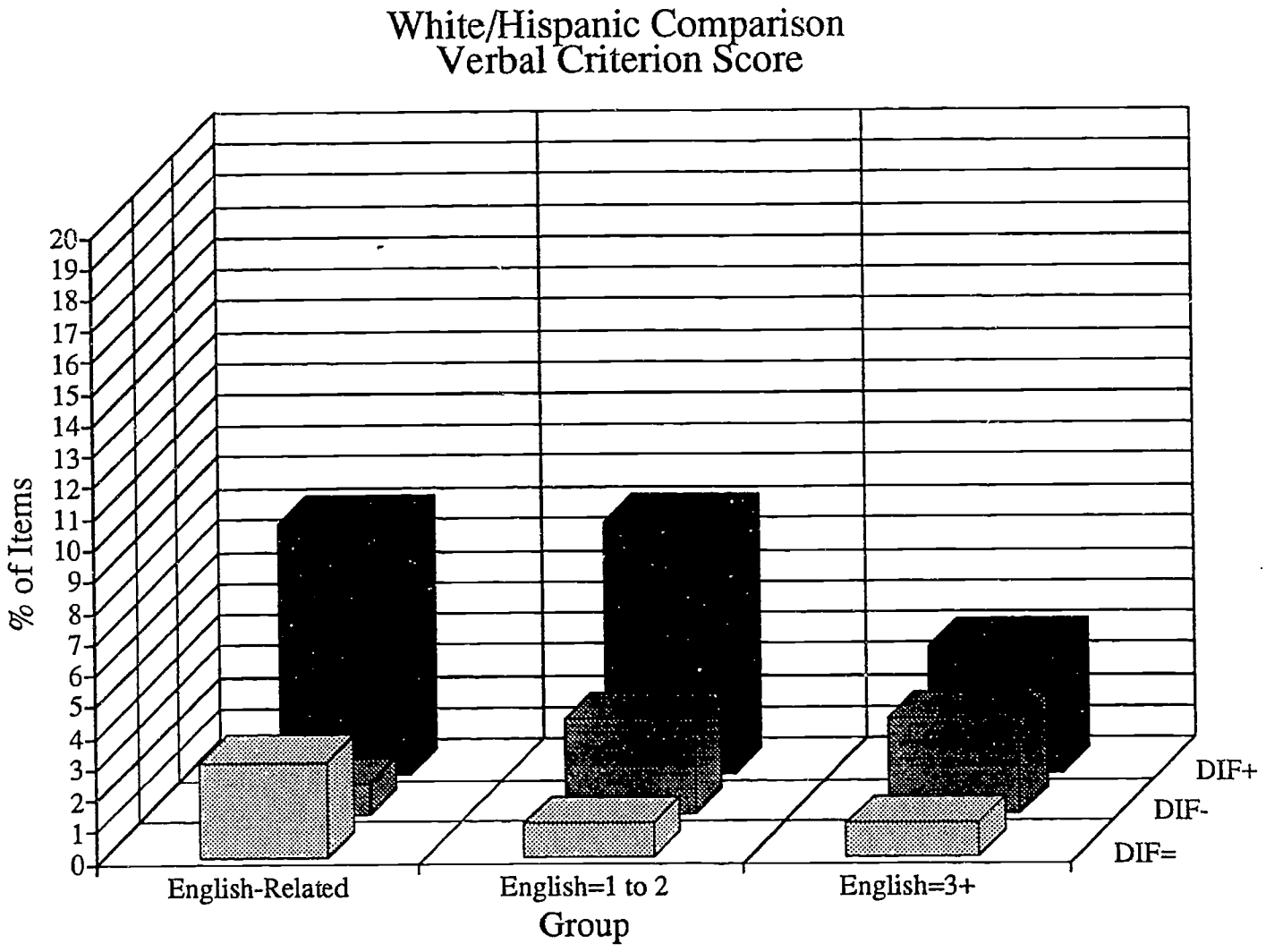

White/Hispanic Comparison
Verbal Criterion Score
% of Items
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
English-Related
English=1 to 2
English=3+
Group
DIF+
DIF-
DIF=

Figure 5

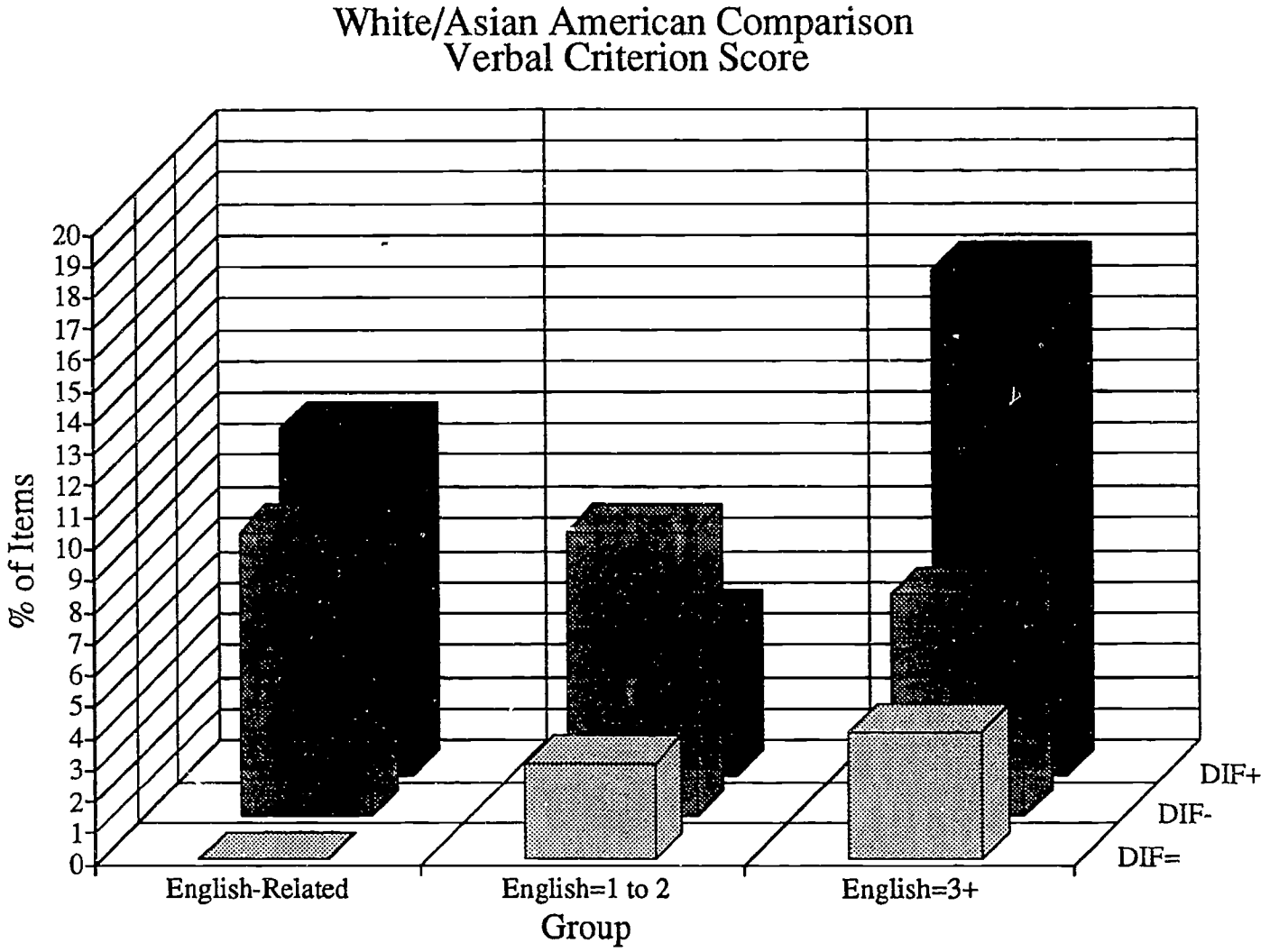

White/Asian American Comparison
Verbal Criterion Score
% of Items
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
English-Related
English=1 to 2
English=3+
Group
DIF+
DIF-
DIF=

Figure 6

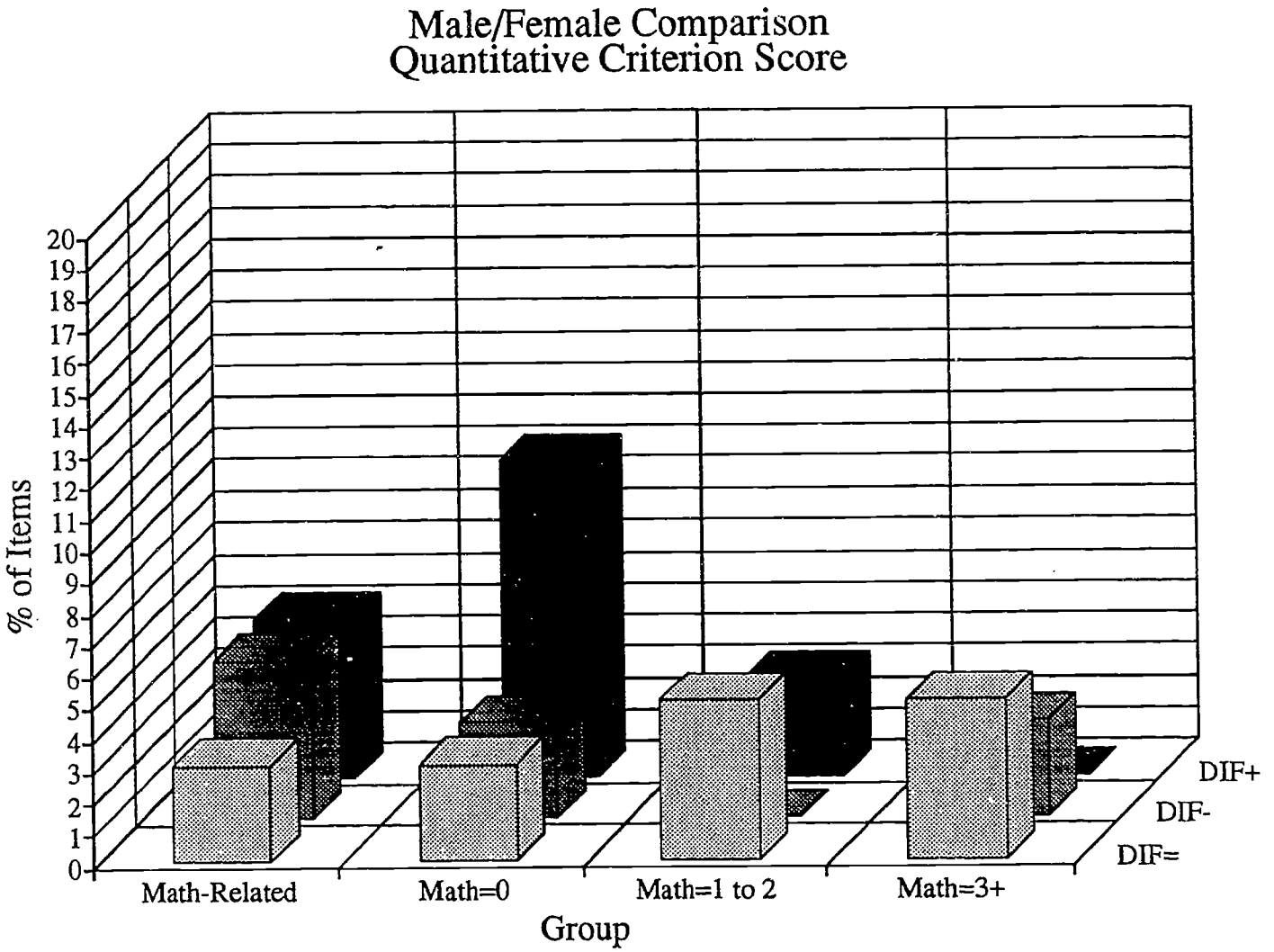

Male/Female Comparison
Quantitative Criterion Score
% of Items
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Math-Related
Math=0
Math=1 to 2
Math=3+
Group
DIF+
DIF-
DIF=

Figure 7

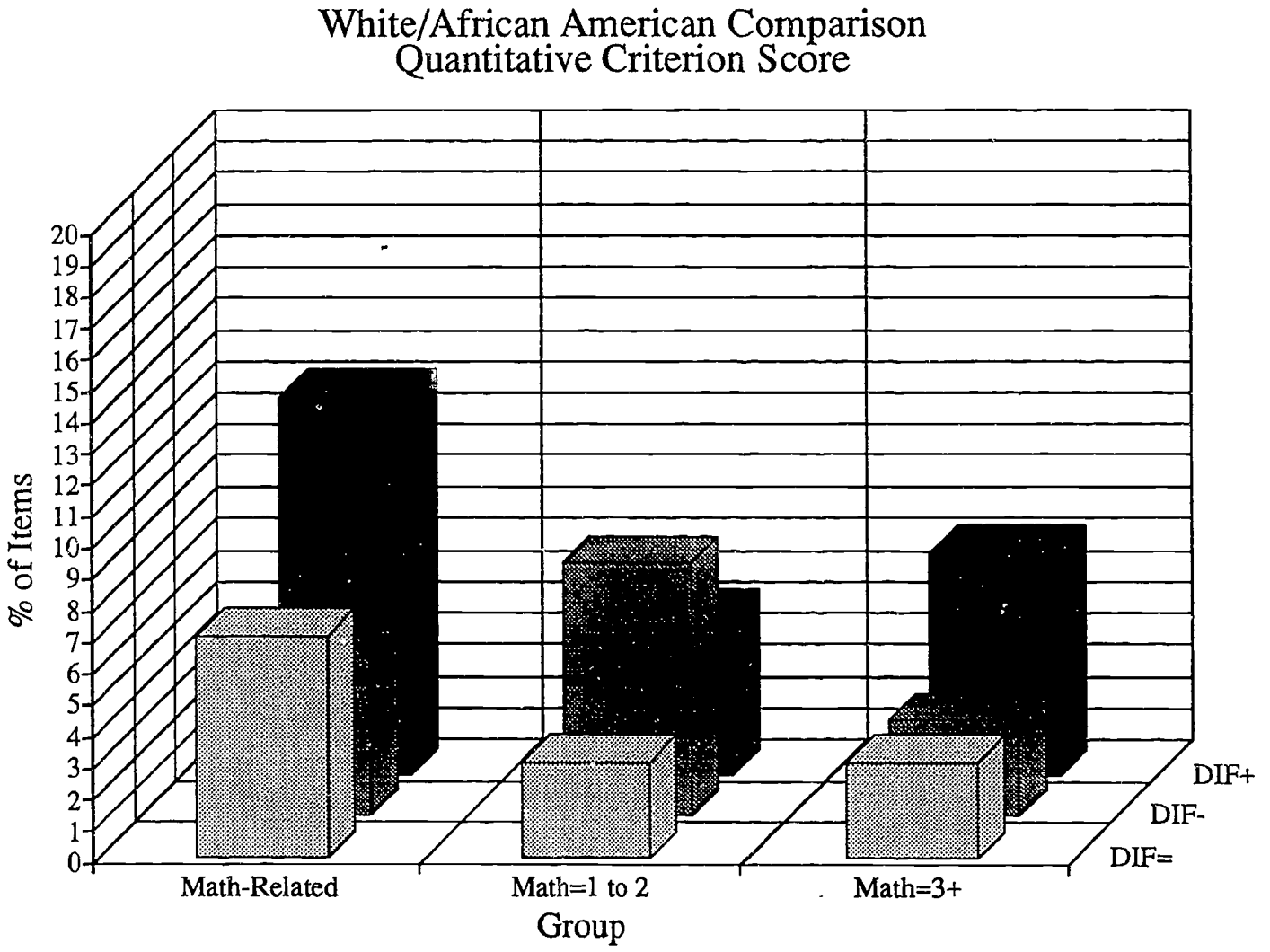

White/African American Comparison
Quantitative Criterion Score
% of Items
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Math-Related
Math=1 to 2
Math=3+
Group
DIF+
DIF-
DIF=

Figure 8

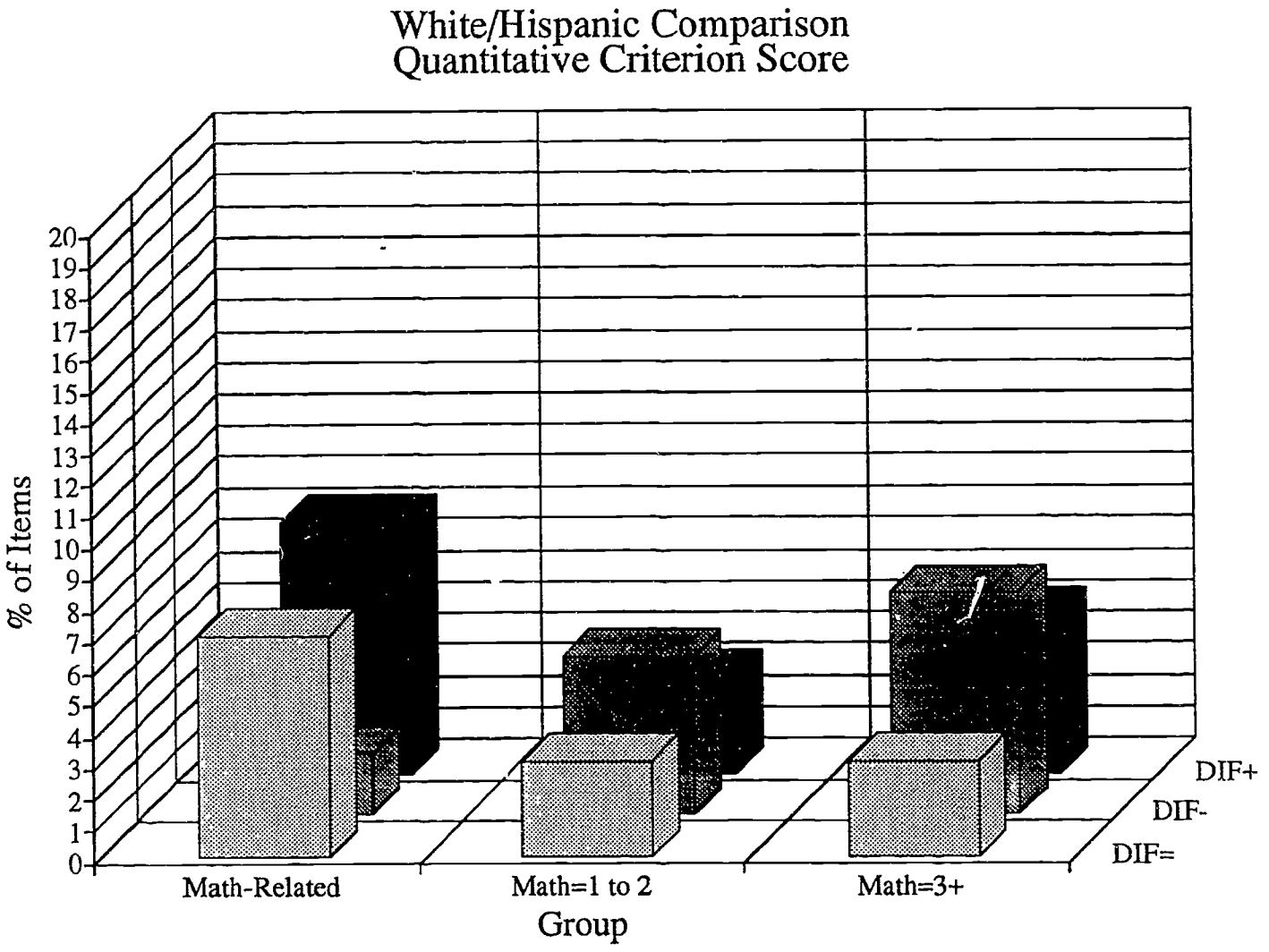
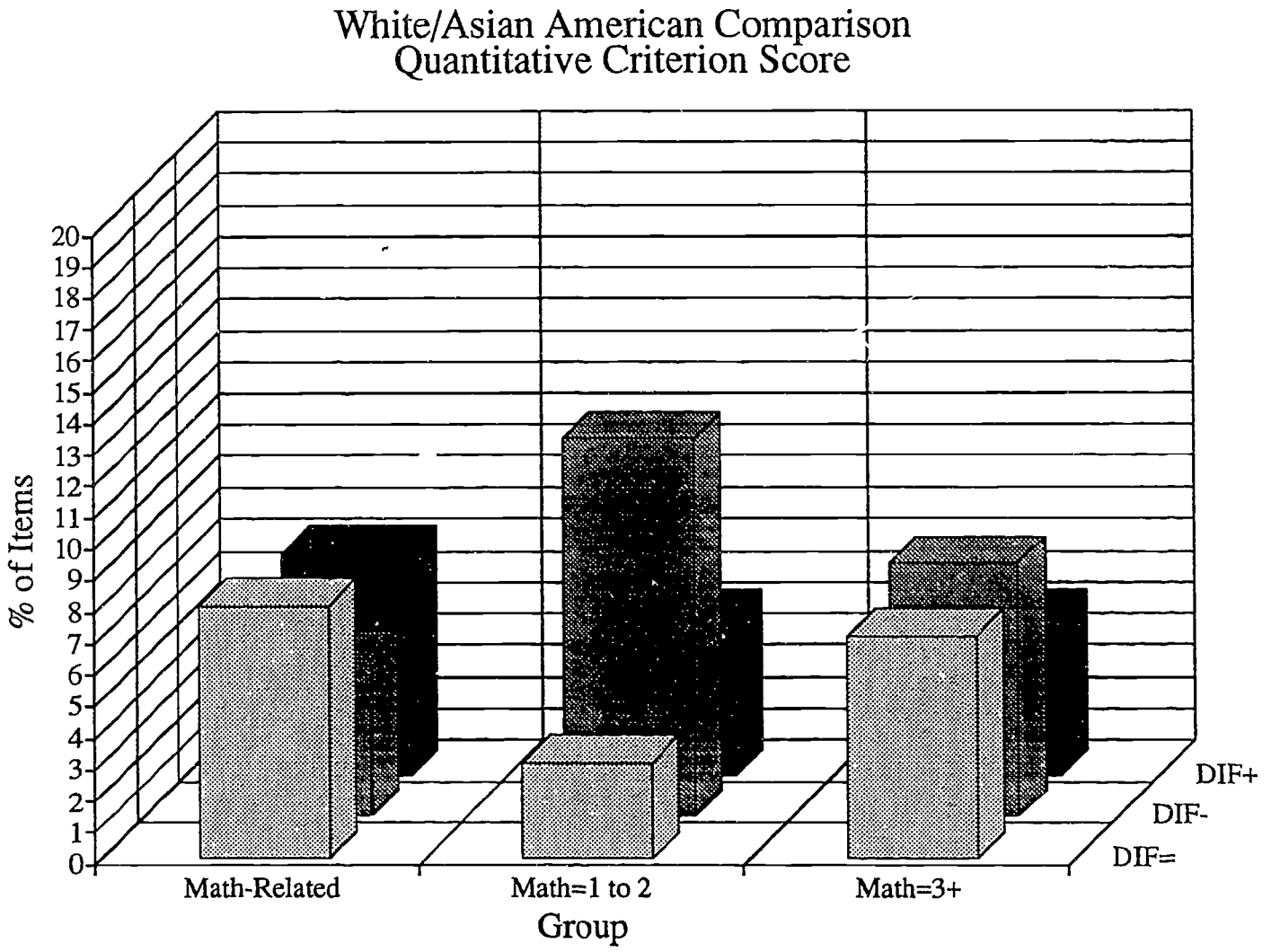

White/Hispanic Comparison
Quantitative Criterion Score
% of Items
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Math-Related
Math=1 to 2
Math=3+
Group
DIF+
DIF-
DIF=

Figure 9


White/Asian American Comparison
Quantitative Criterion Score
% of Items
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
Math-Related
Math=1 to 2
Math=3+
Group
DIF+
DIF-
DIF=