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ABSTRACT

An assessment of sex-related differences in mathematics achievement and related attitude variables of 13-year-old students from 20 different countries is presented in this study. The analyses of student achievement were based on pretest and posttest data from seven of the participating countries and a single-test condition from the remaining 13 countries. Data were obtained from items which addressed the areas of arithmetic, algebra, geometry, measurement, and statistics. An extensive questionnaire, which also contained five subscales, was used to measure student attitudes toward mathematics. The subscales focused on: (1) mathematics as process; (2) home support; (3) mathematics and society; (4) mathematics and myself; and (5) gender stereotyping. The pattern of achievement results indicated that girls were more successful than boys in Belgium, Thailand, Finland and Hungary but least so in France, Nigeria, Israel, and the Netherlands. With regard to attitude measures, the largest differences between countries and sexes occurred for the scale, gender stereotyping. Summaries are provided in table and graph form. (ML)

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DIFFERENCES IN MATHEMATICAL ACHIEVEMENT LEVELS AND IN ATTITUDES FOR GIRLS AND BOYS IN TWENTY COUNTRIES

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DIFFERENCES IN MATHEMATICAL ACHIEVEMENT LEVELS FOR GIRLS AND BOYS IN TWENTY COUNTRIES

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The Second International Mathematics Study (SIMS), carried out in 20 countries, was an investigation into the relationship between teaching and student achievement. It sought detailed information from each of the participating countries on three interrelated aspects of mathematics teaching: the intended curriculum, the implemented curriculum and the attained curriculum.

This paper looks at the attained curriculum and assesses the scope of sex-related differences in the mathematics achievement and related attitude variables of Population A (the grade in which the modal student age lies between 13.0 and 13.11 years by the middle of the school year). This corresponds to the eighth grade in the United States and Canada.

Achievement data will be presented first, followed by those of the attitudes.

A) MATHEMATICAL ACHIEVEMENT

In the past two decades researchers have shown considerable interest in the relationship between the gender and the mathematics achievement of children in the upper grades of the elementary schools. Some studies of sex-related differences have compared total test scores (Backman, 1972; Benbow & Stanley, 1980, 1983; Maccoby & Jacklin, 1974). Others have focused on the proportion of students who answered a particular item correctly, that is, on p-values (Armstrong, 1980; Fennema, 1978, Raphael, Wahlstrom, & McLean, 1984), or on a comparison of the kind of errors made by male and female students (Marshall, 1983).

Studies to date purport to have established, on the one hand, that by age 13 there is a significant difference in mathematical ability between the sexes, and that it is especially pronounced among high-scoring exceptionally gifted students, with boys outnumbering girls 13 to 1 (Benbow & Stanley, 1983); and on the other hand, that very little difference exists, if any, and that when a difference is detected, it favours boys only slightly (Fennema & Carpenter, 1981). According to Schildkamp-Kuendiger (1982), reporting on research carried out in nine countries, sex-related differences in achievement were found to vary considerably both within and among countries.

THE DATA

The 20 countries participating in the study formed two groups. The first group consisted of the 7 countries that took part in the longitudinal version (pretest and posttest), while the second consisted of the 13 countries that took part in the cross-sectional version (tested once only).

The present analyses are based on both the cross-sectional and the longitudinal data. In the cross-sectional part of the study, there were 176 items; 40 items in the Core test and 34 items in each of four Rotated forms, while in the longitudinal part, there were 180 items; 40 in the Core test and 35 items in each of four Rotated forms. There were 157 items common to the two parts, so the total number of items in the present analysis is 199 (180 + 176 - 157). The results for the 157 common items are based upon 20 countries. Of the remaining 42 items, the results for 23 are based on the 7 countries in the longitudinal part of the study, while those for the remaining 19 items are based on the 13 countries in the cross-sectional part.

These items were distributed over 5 major content areas, or subtests, as follows:

INSERT TABLE 1 HERE

This paper reports the results of the five subtests, each of which was analyzed separately. Each subtest comprises items from both the Core form and one of the Rotated forms. Since each student responded to the Core form and to one of the Rotated forms A,B,C, or D, responses to items on the Core form are from the total sample of students, while responses to items on any of the Rotated forms are from only one quarter of the total sample. An item on the Core form thus yields a greater precision of results, since it has about four times as many respondents as one on a Rotated form.

PROCEDURE AND RESULTS

Every response to an item was coded into one of three categories: correct, wrong, or item omitted. Within each country the achievement results were obtained as follows: for each item three percent values (p-values) (correct, wrong and omitted) were calculated separately for boys and for girls, with the student as the unit of analysis. Three mean percent values were then obtained for each sex separately and for each country by averaging the percent values for the individual items in that country. Finally, the mean percent values for subtest, country and sex were averaged to yield an overall (for all the countries) average mean percent value for each sex for each of the subtests, with the item as the unit of analysis.

1. OVERALL DIFFERENCES BETWEEN BOYS AND GIRLS BY SUBTEST

1.1. Boxplots Displays

The boxplots in Figure 1 display the distribution of the differences in percentage of correct answers for all the countries taken together. The major results are the following:

1. The mean difference between girls and boys (defined as girls minus boys) in the Arithmetic subtest (62 items) was zero. The distribution of the differences is shown in the boxplot: the median difference is zero, the range is -9 to 8, and the distribution is more or less uniform across that range.
2. For the Algebra subtest, the mean success rate was slightly higher for girls; the mean difference was 0.5. The boxplot displaying the differences for the 42 items reveals that for 41 items the differences ranged from -3 to +4 with a median of +1, while one item was an outlier with a difference of -7.
3. In Geometry the picture is slightly different: the boys' success rates were higher than the girls' by a mean percent value of 1.7. (As the boxplot shows, there was a difference of 21 percentage points on one of 51 items in that subtest). The girls' performance was higher on one quarter of the items.
4. On the 18-item Statistics subtest girls did slightly better than boys, their mean percent value being 0.4 higher than that of the boys. The boxplot shows that the differences between the sexes ranged from -4 to +3 percentage points.
5. Boys did better than girls on the Measurement sub-

test. For 26 items the mean was higher for boys by 1.4. The differences ranged from -9 to +5. The boys' performance was higher on about 70% of the items.

BOXPLOT OF SUBTESTS HERE

1.2 Overall Differences by Subtest and Item Difficulty

To display the differences between boys and girls as a function of item difficulty, the data were also plotted in 'flat' plots, in which the Y-axis represents the difference in p-values (Girls-Boys) for all the countries taken together, and the X-axis the average in p-values ((Girls + Boys)/2). Thus the differences in p-values were plotted against the total proportion of correct answers - which is, in effect, the index of item difficulty. Each * in the plot represents one item.

A number of points illustrated by these plots may be of interest:

(a) It is evident from the Arithmetic plot that differences between boys and girls tended to be in the boys' favour for the more difficult items (index of difficulty up to 35%), and in the girls' favour for the less difficult ones (index above 65%). The plot of the differences between the genders for items in the middle range of difficulty (35 to 65%) reveals no relationship between the values of X and Y.

(b) In Algebra, the only item that showed a difference exceeding 5% is in the 45% level of difficulty. The differences in the girls' favour are spread over the entire range of item difficulty, as are those in the boys' favour.

(c) The plot for the Geometry subtest indicates that boys did better than girls on the majority of the items over the entire range of difficulty; when results were better for girls, they were also spread out over the entire range. The item on which boys were considerably more successful than girls was not the most difficult; its average rate of success was 59%.

(d) Girls tended to do better than boys on the easier items in the Statistics subtest. The range of difficulty for the items on which the boys were more successful was from 22 to 60, while girls were more successful on items in the difficulty range from 45 to 85.

(e) In measurement there is a clear pattern of greater success rate for boys on the more difficult items. Boys did better than girls on all the items in difficulty range from 18 to 45. For the items in the difficulty rate of 46 or more, there is no clear pattern in the distribution of p-values.

INSERT PLOTS HERE

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2. SEX DIFFERENCES WITHIN AND BETWEEN COUNTRIES

2.1. Paired t tests Analyses

For each subtest and each country the mean percent correct responses for girls was compared to that for boys, using the paired t test with the item as the unit of analysis. Statistical significance at the .01 level in that contest means: if these items were a random sample from a large set of items, then the average difference between the sexes for that set of items is (or is not) zero.

The statistically significanty differences are presented in Table 2-1. A positive difference in mean percent correct represents a high mean percent for girls, a negative difference, a higher mean for boys; a dash (-) indicates that the difference was not statistically significant.

As Table 2 shows, most of the differences did not reach statistical significance at the 1% level. Moreover, the differences that did reach statistical significance were not large, ranging from +5 to -7. Looking at each subtest separately it appears that for two of the five topics, Measurement and Geometry, the significant differences occurred consistently in the boys' favour: in 7 of the 20 countries boys had higher p-values and in 10 countries boys had higher p-values in Measurement and Geometry respectively.

The pattern of results for countries indicates that in relation to boys, girls were more successful in Belgium (fl), Thailand, Belgium (fr), Finland and Hungary, and less so in France, Nigeria, Israel and the Netherlands.

INSERT TABLE 2-1 HERE

2.2. Multivariate Analysis of Variance

Since the same items were administered to all countries the data represent repeated measures of each item, and are certainly not independent or uncorrelated measures, making the assumptions of univariate analysis of variance unrealistic. The advantage of using a multivariate model of analysis of variance is that it allows the country and sex results to be intercorrelated or to display different variances, without invalidating the F-statistic.

The results of the tests of significance for the common items in each of the subtests are listed in Table 2-2.

INSERT TABLE 2-2 HERE

The sex effect exceeds the critical F value at the .01 level for two of the five subtests: Measurement and Geometry. There are no significant differences among sex groups in mean percent correct for Algebra, Arithmetic, and Statistics.

The F statistics for country differences are all significant, that is, for every one of the subtests there are differences among country means.

The multivariate test of the country-by-sex interaction is a test of equality of sex differences across countries. It is significant for all five subtests, and thus indicates that any sex differences that might exist are not consistent across countries.

2.3. Patterns in Two-Way Coded Tables

To describe overall patterns in the data and highlight individual extraordinary data values, the table of differences, between boys and girls, in correct responses by country and by item was reproduced in coded form. In the coded table the actual differences were replaced by one-character codes as follows:

Girls better than boys		Boys better than girls	
Data	Code	Data	Code
10 to 14	·:	10 to 14	-
15 to 19	#	15 to 19	=
20 and above	>	20 and above	<

CODED TABLES HERE

The coded table for the Arithmetic subtest shows that sex alone is not a good predictor of relative success in Arithmetic. Differences of 10 or more percentage points are present in either the girls' or the boys' favour depending on the country. Very few items show consistent differences across countries. On the other hand, country differences show a strong pattern of consistent positive or negative differences. The columns of data for Belgium (fl) and Finland indicate that girls outperform boys by 10% or more on a large number of items; the situation is reversed for France, Israel, Luxembourg, and the Netherlands.

The other four coded tables reveal the same inconsistent pattern of differences in items, except for item #159 in Geometry where in all the countries but England, the boys did much better than girls.

B) ATTITUDES TOWARDS MATHEMATICS

Within the research area "Women and Mathematics", attitudes towards mathematics have been looked at from different points of view:

I) Attitudes have been treated as characteristics of the students which can explain mathematical achievement, at least up to a certain degree. If sex-related achievement differences do occur in a study, different aspects of the global concept "attitudes" are then locked for, either as supposed causes of the achievement differences or as correlates with achievement differences.

If no sex-related achievement differences occur, it is of interest whether or not the relationship between attitudes and achievement is the same for both sexes.

The study of Boswall (1985) is an example of the latter type where no overall achievement differences are found. With regard to attitudes towards mathematics the results are typical. In the case of some attitudinal aspects there are significant differences between male and female students responses and in the case of others there are not. Moreover, dissimilarities between the sexes have been found relative to the relationship between these attitudinal aspects and achievement.

II) Other studies have focused on the development of different aspects of math-related attitudes. How these aspects have been influenced by past events and also their impact on future achievement and course-taking behaviour have been investigated. The development process is often looked upon as being influenced by the perceptions significant others hold about mathematics and/or the students' success and failure experiences in mathematics. Relatively consistently, male and female students differ with regard to their attribution of good and poor math achievement and their selfconfidence in doing mathematics. Sex-related differences seem to occur even when there are no achievement differences (Eccles-Parsons et al. 1982, Hansen & O'Leary 1985, Kuendiger 1985).

Overall, research demonstrates that learning about mathematics leads to sex-related differences for certain attitudinal aspects on the students' side. Moreover, the relationship between attitudes and achievement varies according to the sex of the student.

THE DATA

An extensive questionnaire about different aspects of math related attitudes has been answered by students included in the SIMS. They indicated their opinion on 5-point-scales, reaching from strongly disagree to strongly agree. Results of the following attitude scales are presented:

(a) Mathematics as a Process (15 items).
The extreme positions are characterized by: mathematics is a science which is not going to change in the future, (low score); and mathematics is a developing science, open to changes (high score).

(b) Home Support (9 items).
This scale evaluates the extent to which students perceive their parents as supportive in learning mathematics.

(c) Mathematics and Society (8 items).
These items have been designed to evaluate students'

perception about the practical value of mathematics, or its utility.

(d) Mathematics and Myself (14 items)

The items focus on feelings involved in success and failure experiences as well as on intended effort to keep on with mathematics. The positive extreme position (high score) can be characterized by: feeling good about succeeding in mathematics and by intending to engage oneself further in the subject.

(e) Gender Stererotyping (4 items)

(1) Boys have more natural ability in mathematics than girls.

(2) Boys need to know more mathematics than girls.

(3) Men make better scientists and engineers than women.

(4) A woman needs a career just as much as a man does.

The items are coded so that a high score means: women are as able as men in mathematics, and as engineers. Women need math, and a career, as much as men do.

Results for the following countries will be presented; the code numbers listed are those used when results are displayed:

Belgium (fr) (16)
Canada, British Columbia (22)
Canada, Ontario (25)
Finland (39)
France (40)
Hong Kong (43)
Hungary (44)
Israel (50)
Japan (54)
Luxembourg (59)
Netherlands (62)
New Zealand (63)
Nigeria (64)
Scotland (72)
Swaziland (75)
Sweden (76)
Thailand (79)
U.S.A. (81)

Apart from Belgium (fl) (15) and England (37), these are the same countries for which achievement results were reported earlier in this paper. Belgium (fl) is excluded here as for most of the questionnaires the information about the sex of the students is not available. England (37) will be included, as soon as confirmed results are available.

Moreover, it should be noted that for Canada, Ontario (16), the results for 3 out of 8 items in the scale "Mathematics and Society" are not available. For Scotland (72) the results for 2 out of 9 items in the scale "Home Support" are not available.

PROCEDURES AND RESULTS

Students' attitudes are looked upon as outcomes of their learning about mathematics. The following questions will be approached:

- Are these attitudinal learning outcomes mostly the same for boys and girls in a country?
- If not, is there some kind of pattern in the differences between countries?

Up to now only descriptive information is available to answer these questions.

An initial impression of the variety of results was obtained by calculating arithmetic means and standard deviations for each subscale and each set to characterize the distribution in each country.

A more detailed insight will be gained by comparing the percentages of extreme responses of girls with those of boys on the items level. At the moment these results are available only for the subscale "Gender Stereotyping".

For Graph B1 to B5 arithmetic means for the 5 subscales are displayed by countries. The arithmetic means of girls $\overline{X}_{♀}$ are plotted against the difference of means of girls and boys $\overline{X}_{♀} - \overline{X}_{♂}$.

If necessary the items have been inverted, so that a higher mean indicates a more favourable attitude.

1) Subscale: "Mathematics as Process"

INSERT GRAPH B 1

The results are mostly the same for all countries and both sexes:

- all arithmetic means for girls are included in the interval: $2.9 < \bar{X}_{♀} < 3.3$
- all mean differences between the sexes are included in the interval: $-0.04 < \bar{X}_{♀} - \bar{X}_{♂} < 0.07$
- all standard deviations lie in the interval: $0.22 < s < 0.36$

For this scale the most outstanding feature is the consistency of responses with regard to both the sexes and the countries.

2) Subscales: "Home Support"; "Mathematics and Society"; and "Mathematics and Myself"

INSERT GRAPH B 2, 3, and 4

Results for these three scales are quite similar. The arithmetic means of girls vary more strongly than for the scale "Math as a Process". The intervals are:

"Home Support"	$1.9 < \bar{X}_{♀} < 3.0$
"Mathematics and Society"	$2.9 \leq \bar{X}_{♀} \leq 3.9$
"Mathematics and Myself"	$3.0 \leq \bar{X}_{♀} \leq 4.0$

For all three scales most of the differences are located in the interval: $-0.15 \leqslant \overline{X}_{♀} - \overline{X}_{♂} \leqslant 0.15$.

Exceptions are:

a) for the scale: "Home Support"
the Netherlands (62) with girls perceiving more support, and Thailand (79) with girls perceiving less support by their parents compared to boys;

b) for the scale: "Mathematics and Society"
the Netherlands (62), Luxembourg (59) and France (40), with girls evaluating the practical value of mathematics, or its utility, comparatively lower;

c) for the scale: "Mathematics and Myself"
the Netherlands (62) with girls having a more negative view. Nigeria (64) lies with $\overline{X}_{♀} - \overline{X}_{♂} = -0.16$ just outside the borders.

Standard deviations vary in similar ways for all three scales: $0.44 \leqslant s \leqslant 0.75$, indicating a higher variety between countries as well as between sexes when compared to the scale "Math as a Process".

3) <u>Subscale: "Gender Stereotyping"</u>

INSERT GRAPH B 5

Results of this scale demonstrate the highest differences among countries and between sexes so far.
Girls' mean responses range between $2.7 < \overline{X}_{♀} < 4.5$,
mean sex differences between $-0.5 < \overline{X}_{♀} - \overline{X}_{♂} < 1.0$,
and standard deviations between $0.6 < s < 1.0$.

The countries with outlying results are:

- Swaziland (75) where the girls have the least favourable attitude, even lower than that of the boys;
- Japan (54) and Nigeria (64); for these two countries the girls; means are relatively low too, with Japan showing comparatively low sex differences and Nigeria comparatively high sex differences in favour of girls.

For further insight, results of each of the 4 items are displayed separately. It should be noted that 3 of the 4 items are phrased negatively; for these items girls' percentages of the categories 'disagree' and 'strongly disagree' are plotted against the sex differences of these percentages. For the positively phrased item the corresponding results of the categories 'agree' and 'strongly agree' are plotted.

INSERT GRAPH B6 to 9

In all graphs the line indicating extreme responses of 50% of the boys has been entered. For the two items referring directly to mathematics, there is quite a variation with regard to extreme boys' responses. For the item, "Men make better scientists and engineers than girls", less than 50% for all countries except Swaziland (75). For the item, "A woman needs a career just as much as a man does", the opposite is mostly true. In all countries besides Swaziland (75) and Japan (59), more than 50% of the boys agree or strongly agree, although the responses of the girls are more extreme.

D) SUMMARY

The pattern of achievement results indicates that in relation to boys, girls were more successful in Belgium (fl), Thailand, Belgium (fr), Finland and Hungary, and least so in France, Nigeria, Israel and the Netherlands. None of these differences exceeded 7%.

With regard to the attitude scales considered here, the largest differences between countries and sexes occurred for the scale "Gender Stereotyping".

Looking at the attitudinal results under the perspective of sex-related achievement differences, the question arises whether there is a relationship between these two learning outcomes.

The attitudes scales reveal the following:

a) in countries where the achievement results favour boys, boys also have more positive attitudes with regard to the subscales "Mathematics and Myself" and "Mathematics and Society";

b) in countries where the achievement results favour girls, the mean results for girls are more positive than or equal to those of the boys with regard to the same subscales.

But the mean scale differences are only small. It will be investigated if this pattern becomes more obvious on the item level.

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Table 1: Number of items in each subtest

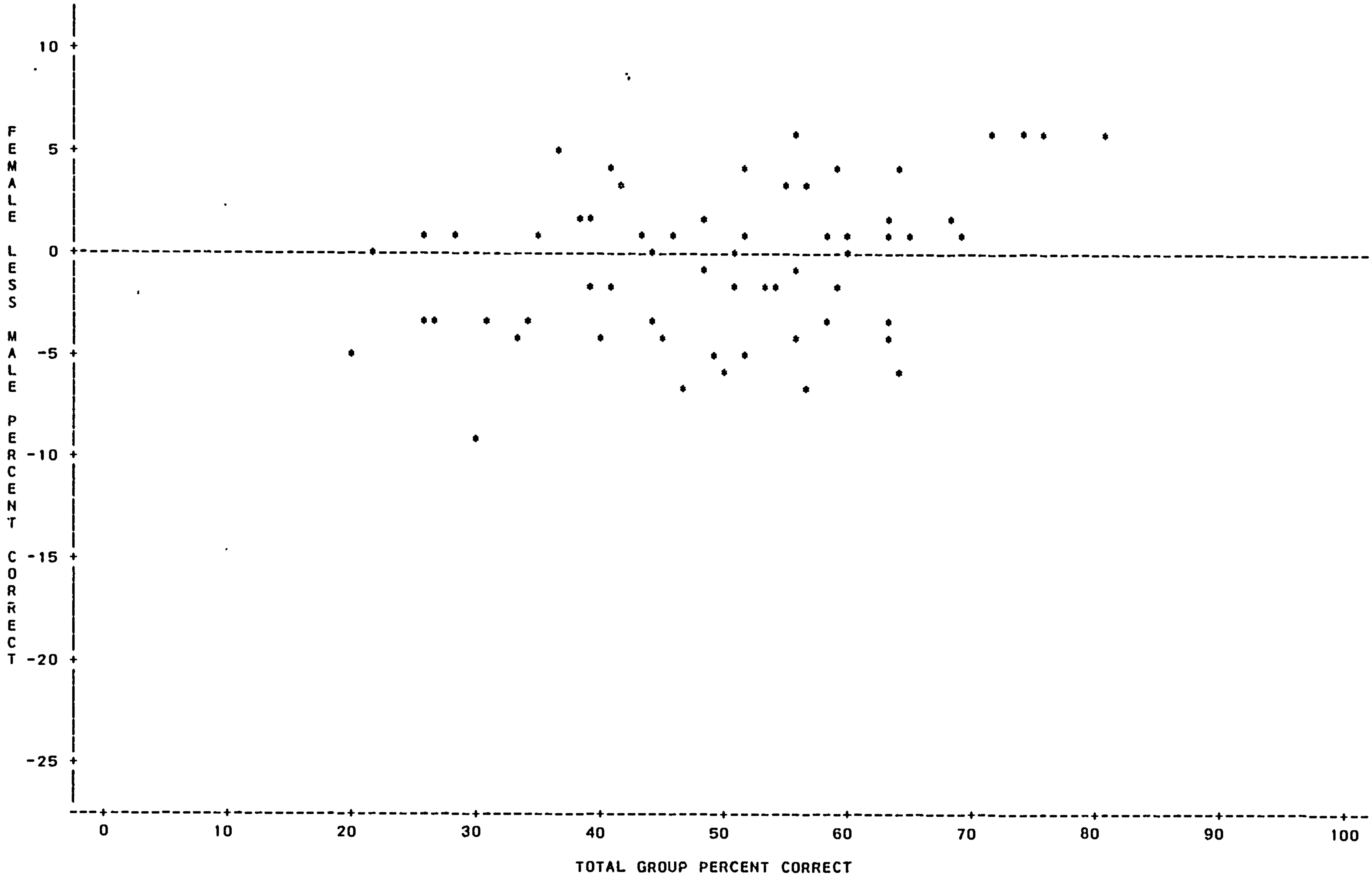
Subtest	Number of Items		
	Longitudinal	Cross-Sectional	Common
Arithmetic	62	46	46
Algebra	32	40	29
Geometry	42	48	40
Measurement	26	24	24
Statistics	18	18	18
Total	180	176	157

```
MTB > boxp c2 c1

                               --------
      0                ---------I   +  I------
                               --------

                                  -----
      1                   *    ---I + I----
                                  -----

                                -------
      2 0                 ----I    +I---------
                                -------

                                   -------
      3                         ---I  +  I-
                                   -------

                                --------
      4                -------I +    I-----
                                --------

         -+---------+---------+---------+--------

ONE HORIZONTAL SPACE = 0.70E+00
FIRST TICK AT    -21.000
MTB > stop
```

ITEMS BY FEMALE-MALE PERCENT CORRECT AND ITEM DIFFICULTY
BY SUBTEST: POPULATION 3

SUBTEST=ARITHMETIC

PLOT OF FM*TOTAL SYMBOL USED IS *

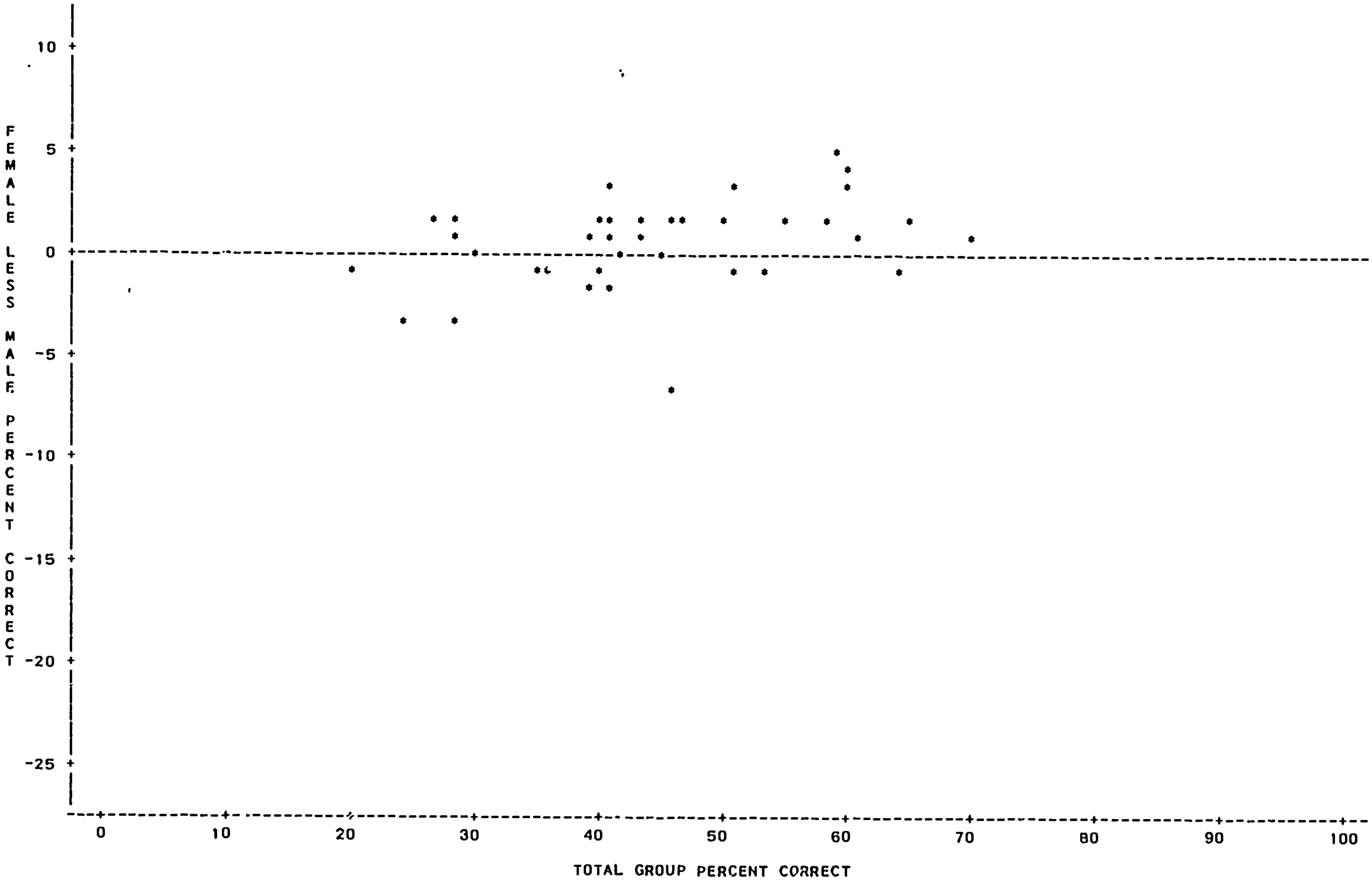


NOTE: 1 OBS HIDDEN

ITEMS BY FEMALE-MALE PERCENT CORRECT AND ITEM DIFFICULTY
BY SUBTEST: POPULATION A

SUBTEST=ALGEBRA

PLOT OF FM*TOTAL   SYMBOL USED IS *

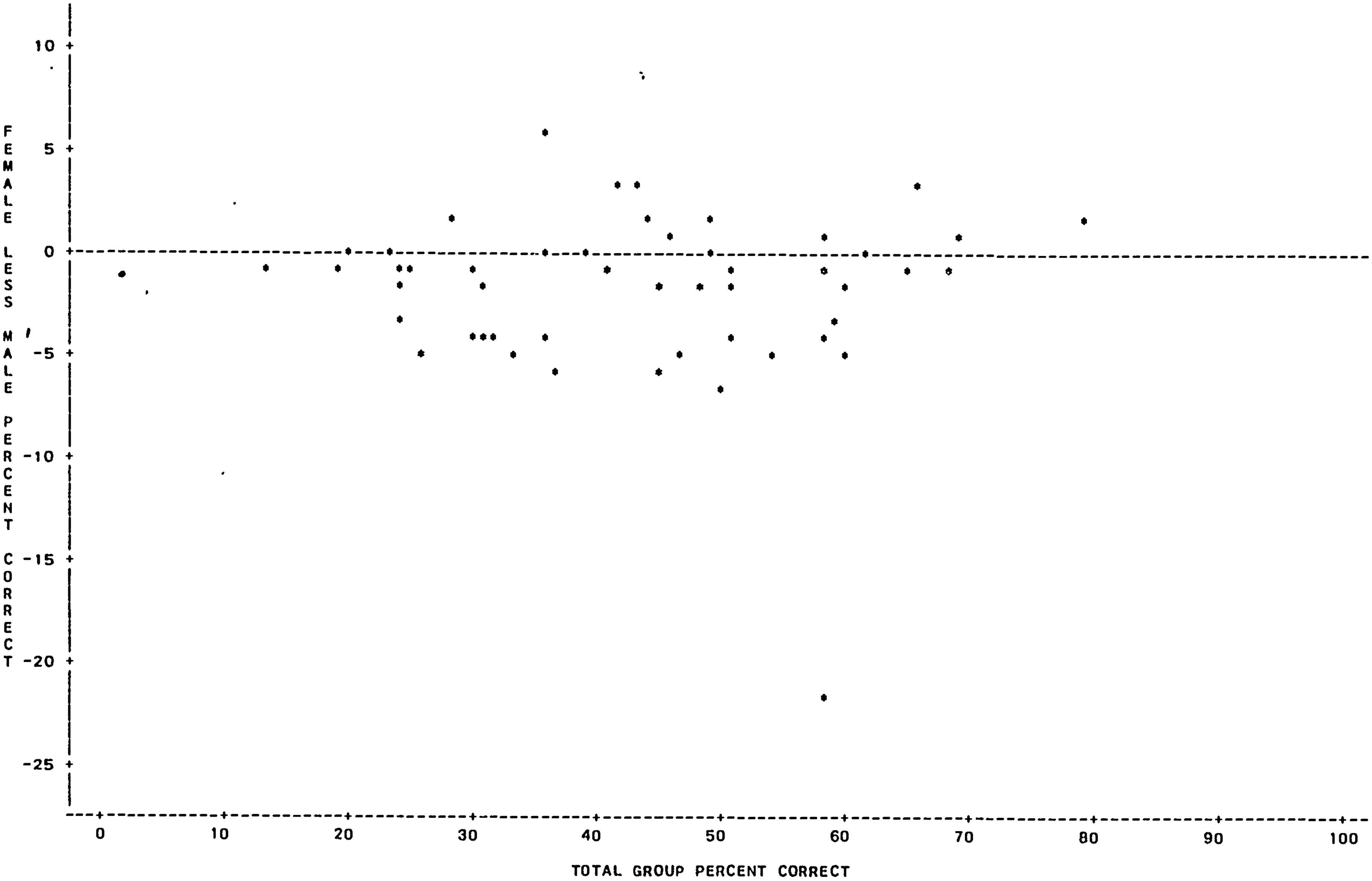


NOTE: 5 OBS HIDDEN

ITEMS BY FEMALE-MALE PERCENT CORRECT AND ITEM DIFFICULTY
BY SUBTEST: POPULATION A

SUBTEST=GEOMETRY

PLOT OF FM*TOTAL SYMBOL USED IS *

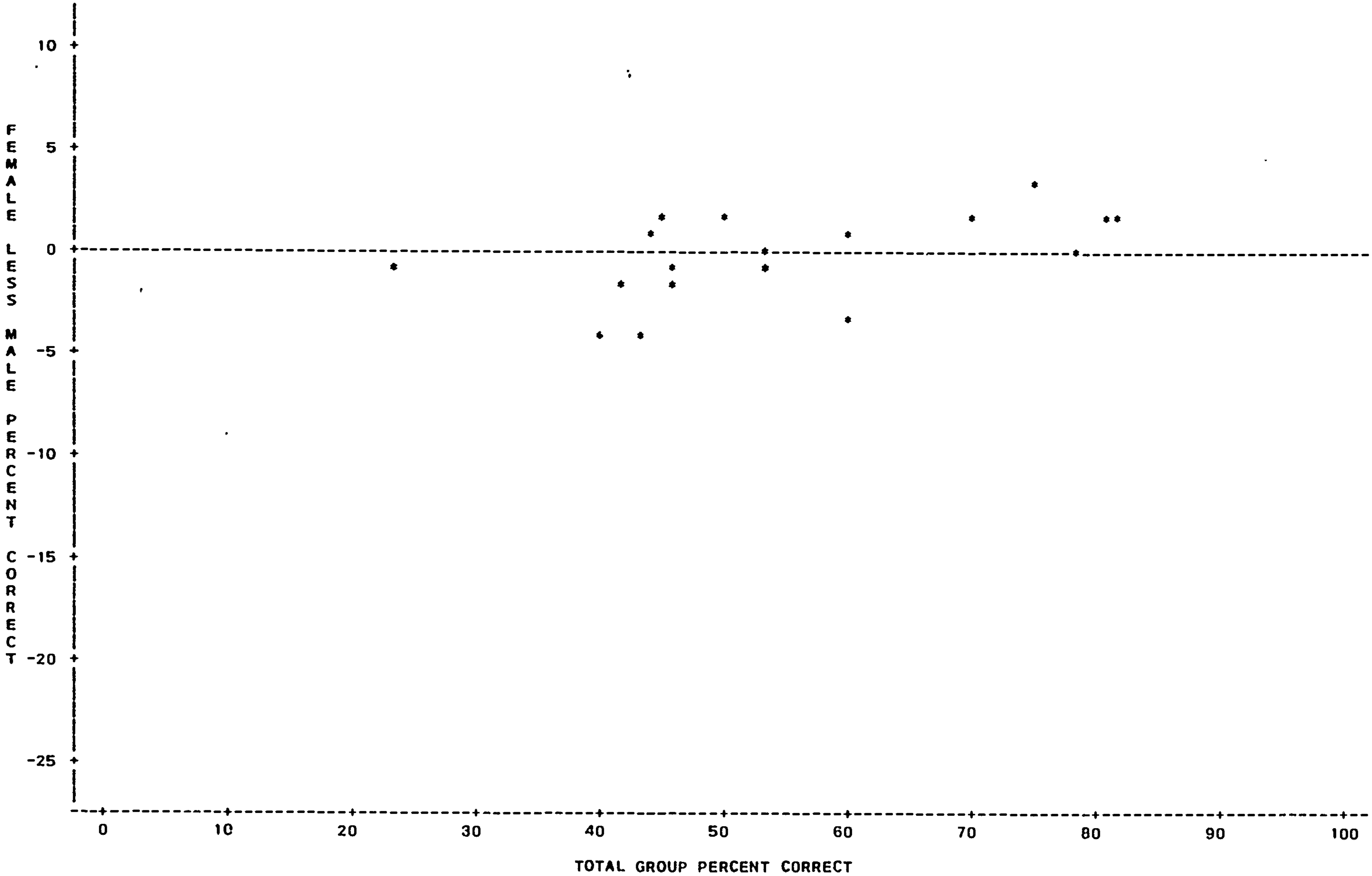


NOTE: 1 OBS HIDDEN

ITEMS BY FEMALE-MALE PERCENT CORRECT AND ITEM OIFFICULTY
BY SUBTEST: POPULATION A

SUBTEST=PROBABILITY & STATISTICS

PLOT OF FM*TOTAL   SYMBOL USEO IS *



ITEMS BY FEMALE-MALE PERCENT CORRECT AND ITEM DIFFICULTY
BY SUBTEST: POPULATION A

SUBTEST=MEASUREMENT

PLOT OF FM*TOTAL   SYMBOL USED IS *

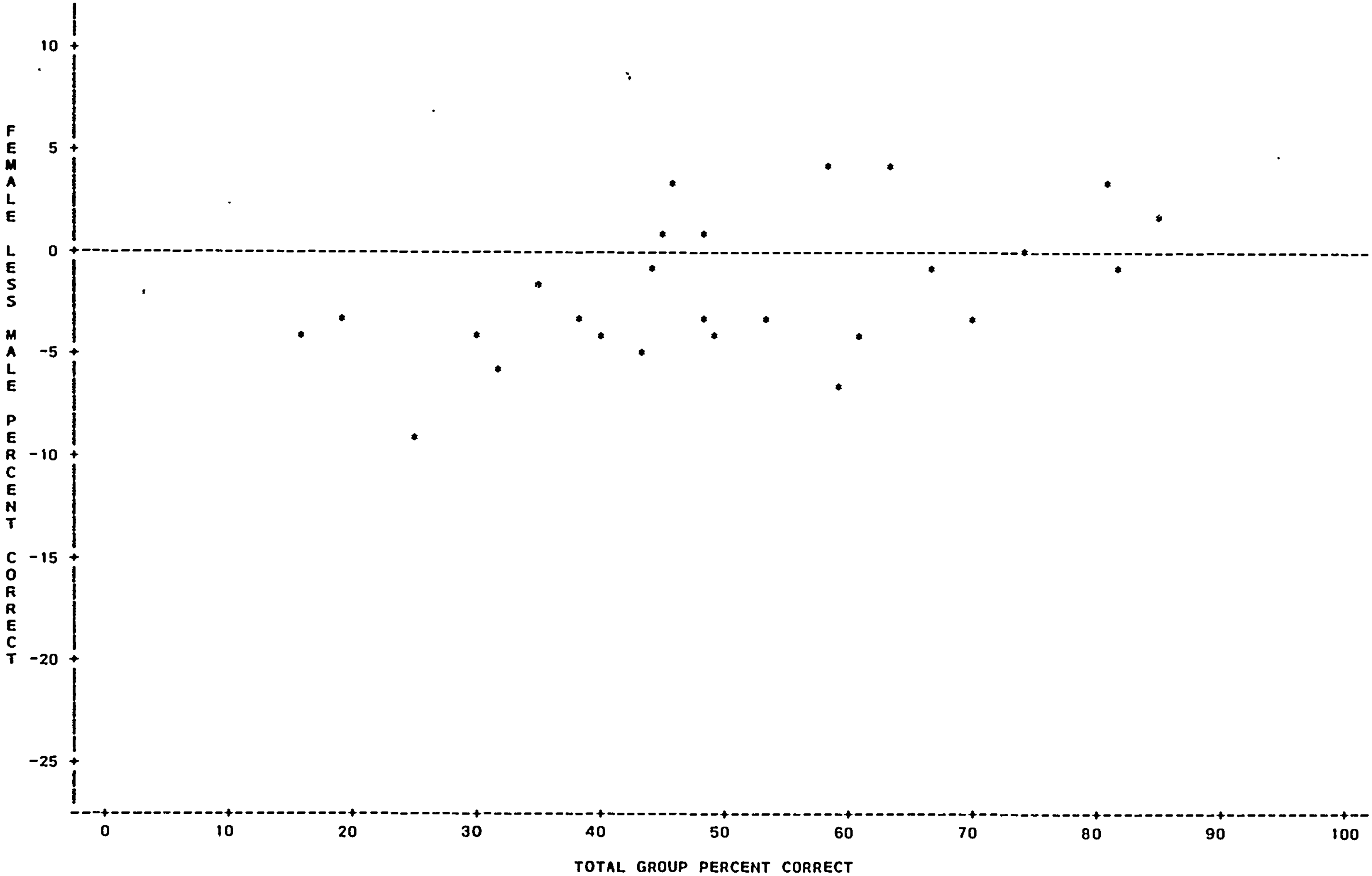


Table 2-1: Mean Percent Differences of Correct Responses Reaching Statistical Significance at the 1% Level by Country and Subtest

	Alg (32)	Arith (62)	Stats (18)	Meas (26)	Geom (42)
Belgium (fl)	+5	+4	—	—	—
Thailand	+2	+2	—	—	—
British Columbia	—	—	—	—	-2
USA	—	—	—	-2	-2
Ontario	—	—	—	-3	-2
New Zealand	—	-2	—	-3	-3
France	-2	-4	-3	-5	-6

	Alg (40)	Arith (46)	Stats (18)	Meas (24)	Geom (48)
Belgium (fr)	+4	+2	—	—	—
Finland	+5	—	+4	—	—
Hungary	+4	—	—	—	—
England	—	—	—	—	—
Japan	—	—	—	—	—
Scotland	—	—	—	—	—
Swaziland	—	—	—	—	—
Sweden	—	—	—	—	—
Hong Kong	—	—	—	—	-2
Luxembourg	—	-4	—	—	-5
Nigeria	-4	-3	—	-4	-3
Israel	-2	-3	-5	-6	-5
Netherlands	-1	-4	-3	-7	-5

Table 2-2: Summary of Multivariate Analysis of Variance for Two-Way Design: F-Values by Subtest and Source of Variation

Source	DF	Alg (30)	Arith (46)	Stats (18)	Meas (24)	Geom (40)
Sex	1	1.39	.17	.15	8.75*	12.33*
Country	19	20.28*	24.76*	25.62*	11.86*	12.33*
Country x Sex	19	9.81*	10.18*	6.65*	10.20*	8.03*

Arithmatic Subtest

OBS	HUNG_NO	BFL	BC	ONT	FRA	NZE	THA	USA	BFR	ENG	FIN	HK	HUN	ISR	JAP	LUX	NET	NIG	SCO	SWA	SWE
1	1	>									#										+
2	2																				
3	41	+									#									+	+
4	42		-	-		-		-			-						-		=		-
5	74								#		+			-							
6	73	#									#								+		+
7	105	+																			
8	106				-												-	-			
9	138										+										
10	137																				
11	4																				
12	3	+	+				+				#		+								
13	44				-																
14	43	+														-	-				
15	75				-		+							-		<		-			
16	76													-			-		-		
17	107	+							+		+							-			
18	139	+	#								#		+					-	+		
19	185																				
20	187	+					+														
21	188																				
22	186	+																			
23	6															-					
24	5		+						+		+										
25	7				-											-					
26	45																				
27	78														-		-				-
28	77	+																			
29	108										+			+							+
30	109		+				+				#										#
31	141				-								-	=		=	=				=
32	140					-							>								
33	182																				
34	184				-																
35	183																				
36	8																				
37	9				=									-		<	-		-		
38	46				-																
39	47				=									-				-			
40	79													=		-	-		-		
41	110				-				-		-			=			=				
42	143														+						
43	142	+																			
44	189																				
45	181					-															
46	190																				
47	179	-	-		-	-															
48	191				-																
49	192				-			-													
50	178	+																			
51	177																				
52	180																				
53	80								+												
54	111	#									+		+			+					

OBS	HUNG_NO	BFL	BC	ONT	FRA	NZE	THA	USA	BFR	ENG	FIN	HK	HUN	ISR	JAP	LUX	NET	NIG	SCO	SWA	SWE
55	144				-									-		-					
56	10										+		+								
57	48															-					
58	112																				
59	11				-												-				
60	81								+							-	-	-			
61	145								-							=	-				
62	146								[illegible]									=			

37

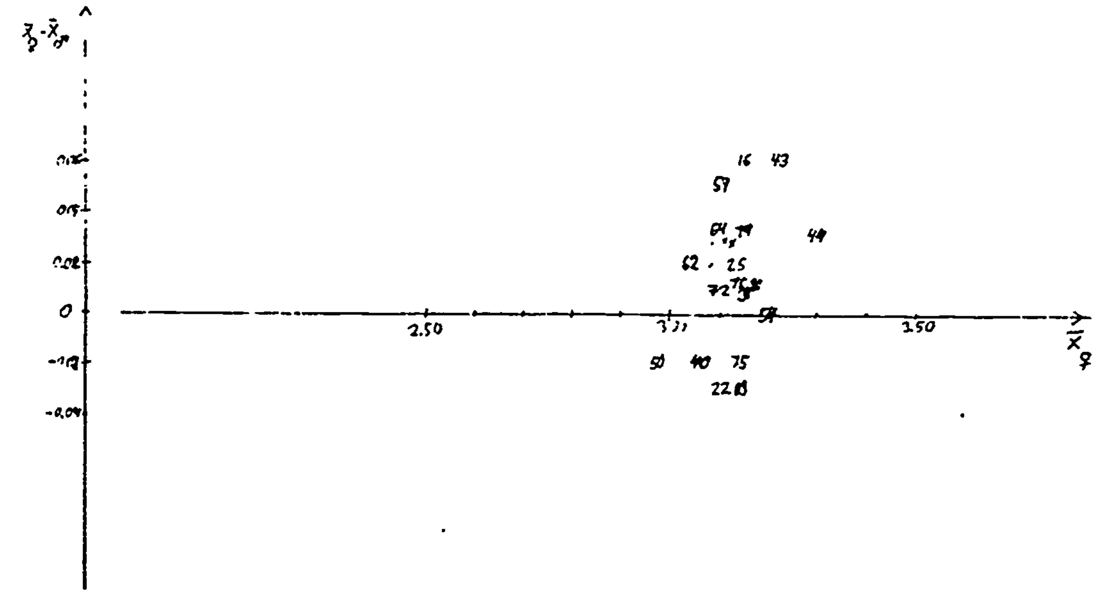
OBS	HUNG_NO	BFL	BC	ONT	FRA	NZE	THA	USA	BFR	ENG	FIN	HK	HUN	ISR	JAP	LUX	NET	NIG	SCO	SWA	SWE
1	12																				
2	13		-		=	-										-			-		
3	50																				
4	49										+										
5	82								+		+										
6	114																	-			
7	113																				
8	14																				
9	51																				
10	83															-					
11	147																				
12	84															-			-		
13	172													-							
14	15								+		+		+								
15	16																				
16	52																				
17	85	+									+							-			
18	116																				
19	115						+		+		+		+								
20	148												+								
21	149						+				+				+						
22	195	+																			
23	53																				
24	88								+												
25	150																				
26	17										+										
27	18																				
28	54	+									+										
29	86						+				+				-			-	-		
30	87																				
31	117		+										+			+					
32	118																				
33	151												+								
34	196	+																			
35	19																				
36	55																				
37	119										+							<			
38	152															-					
39	20								+												
40	56																				
41	120	+							+												
42	153																				

40

OBS	HUNG_NO	BFL	BC	ONT	FRA	NZE	THA	USA	BFR	ENG	FIN	HK	HUN	ISR	JAP	LUX	NET	NIG	SCO	SWA	SWE
1	21	+									+										
2	57																				
3	89	+									+		+								+
4	121																				+
5	154															=		-			
6	22			+	-		-							-		=				-	
7	23	-			-											-	-				
8	58				-								=			-					
9	59												-								
10	90													-		=					
11	128								+							-					
12	123													-							
13	122																-			+	
14	155															-	-	-			
15	25																				
16	24	+																			
17	91	+							+												
18	124																				
19	26		-	-	-									=		-	-		-		
20	60								-										-		
21	92								[illegible]				-	-			-				
22	125									-											
23	156																-	-			
24	197																				
25	176													-							
26	27																				
27	93																	=			
28	193																				
29	29																				
30	28										+										
31	169										-		<				-	-			
32	61															+					
33	94								+		+										
34	175																				
35	126																				
36	62																-				
37	95													-		=	-				
38	127	-			-											-	-				
39	157																				
40	30															-					
41	63												-						-		
42	96																				
43	158															-	-				
44	64																			-	
45	31																				
46	159	<	<	=	<	<	=	<	-		<	<	<	<	=	<	<	-	<	=	<
47	198																				
48	173																				
49	171								+									+			
50	174				-							-					-				-
51	170																				

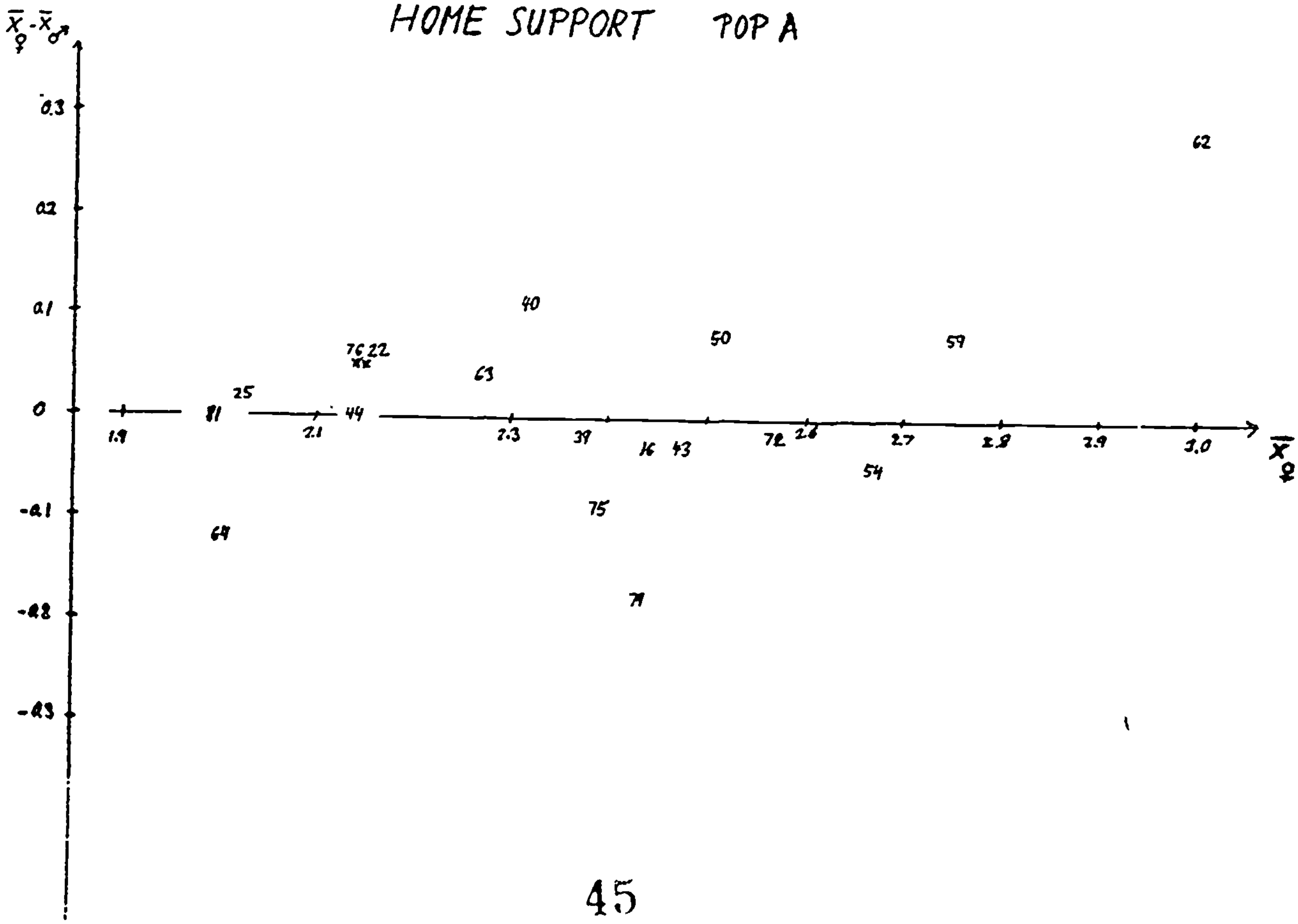
OBS	HUNG_NO	BFL	BC	ONT	FRA	NZE	THA	USA	BFR	ENG	FIN	HK	HUN	ISR	JAP	LUX	NET	NIG	SCO	SWA	SWE
1	65															+					
2	32	+									+										
3	97													−					=		
4	131								+												
5	34	+																			
6	33																				
7	66				−			−										−		−	
8	98								+		+										
9	129																				
10	160															−				+	
11	161															−					
12	35	+																			
13	67										+							=			
14	99				−									−			−				
15	130		−							−							−				
16	132										+										
17	162													−							
18	163													=							

GRAPH B1 MATHEMATICS AS A PROCESS POP A

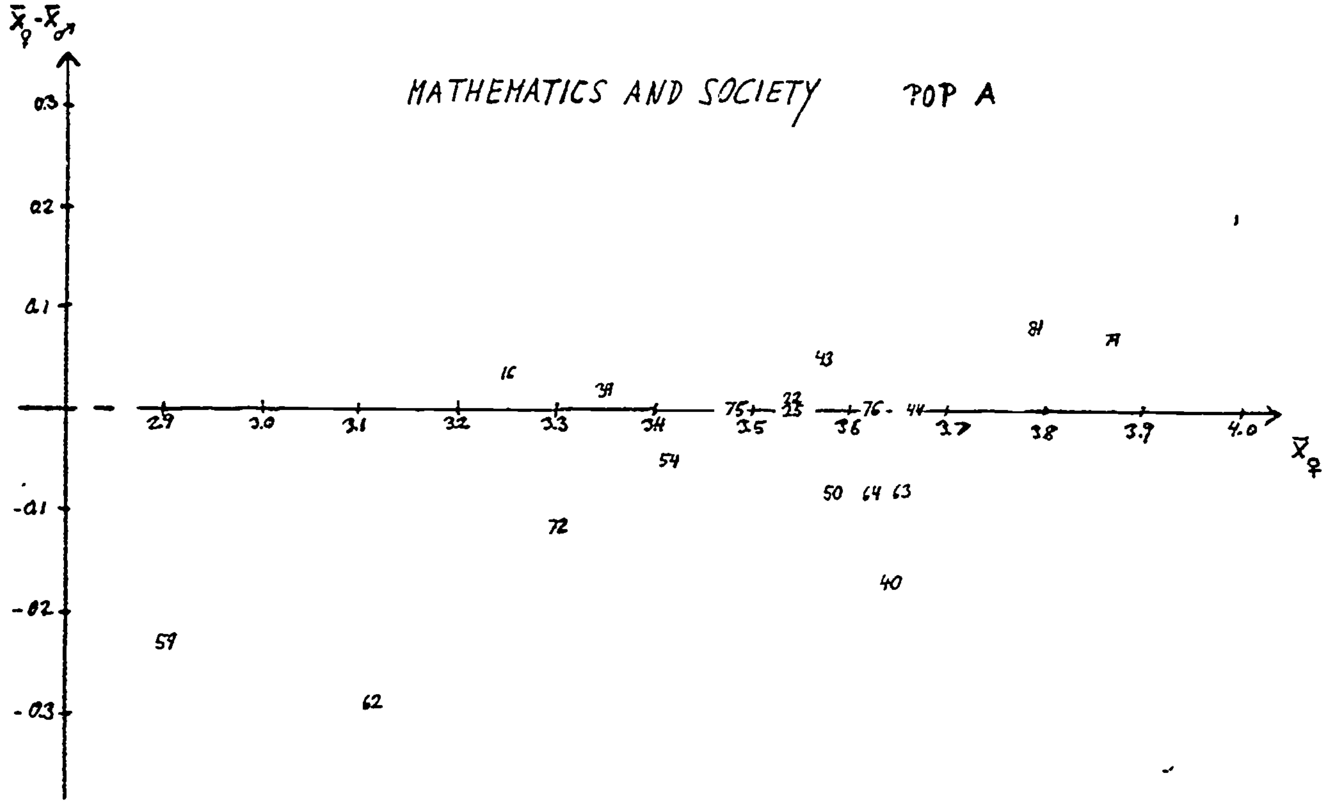


GRAPH B2

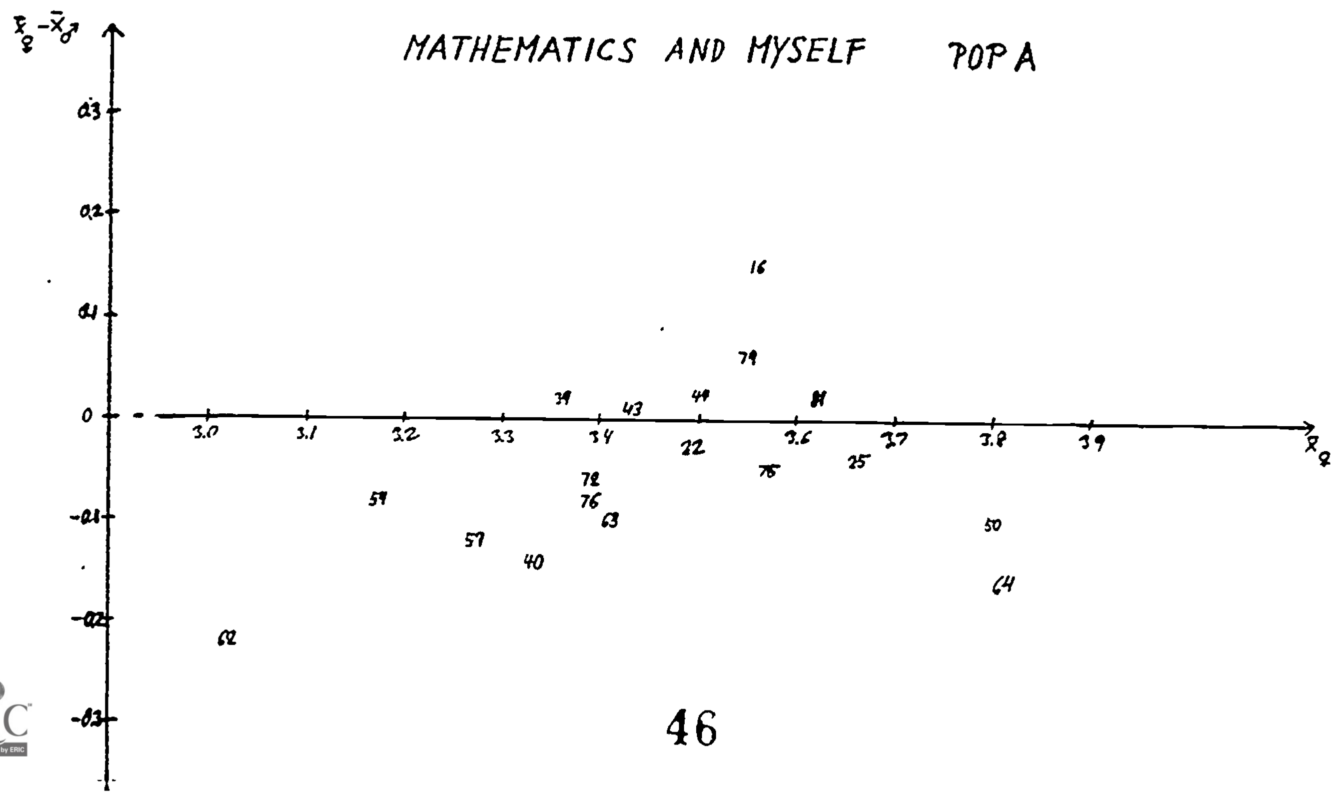
HOME SUPPORT POP A



GRAPH B3

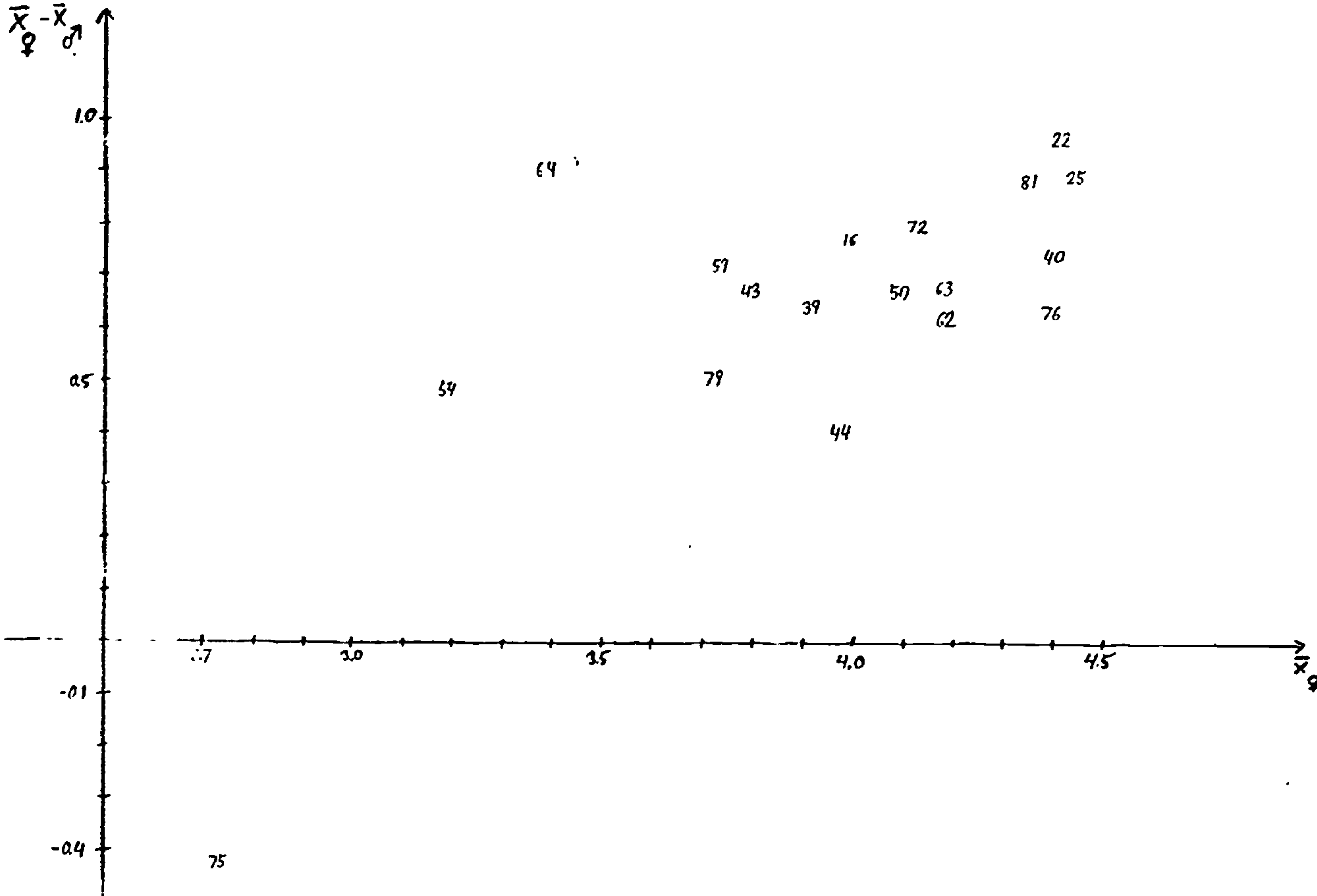


GRAPH B4



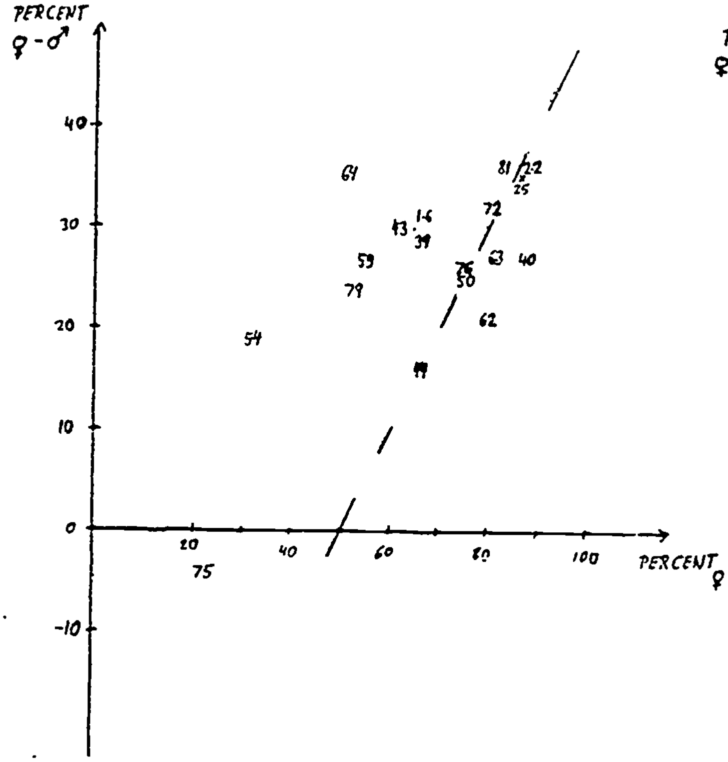
GRAPH B5

GENDER STEREOTYPING POP A



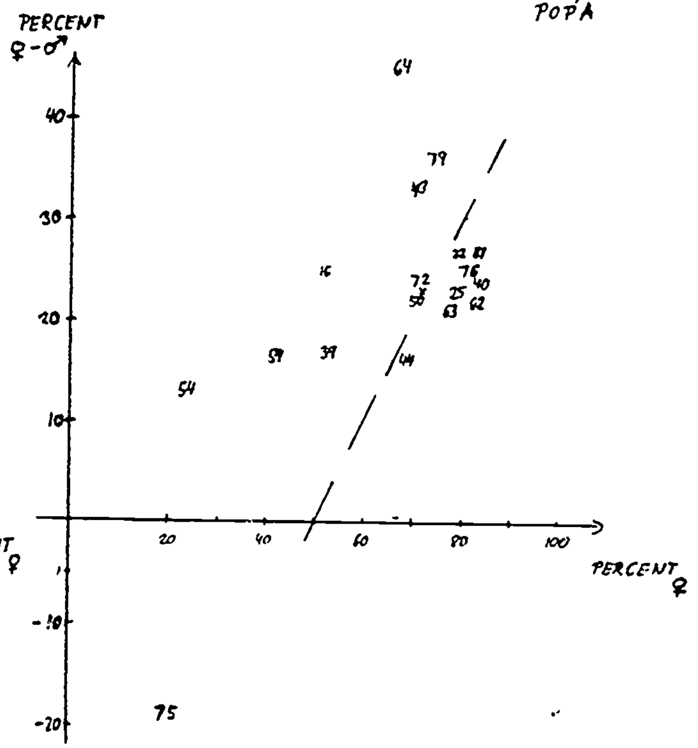
GRAPH B.6

BOYS HAVE MORE NATURAL MATH ABILITY
PERCENT DISAGEE AND STONGLY DISAGREE



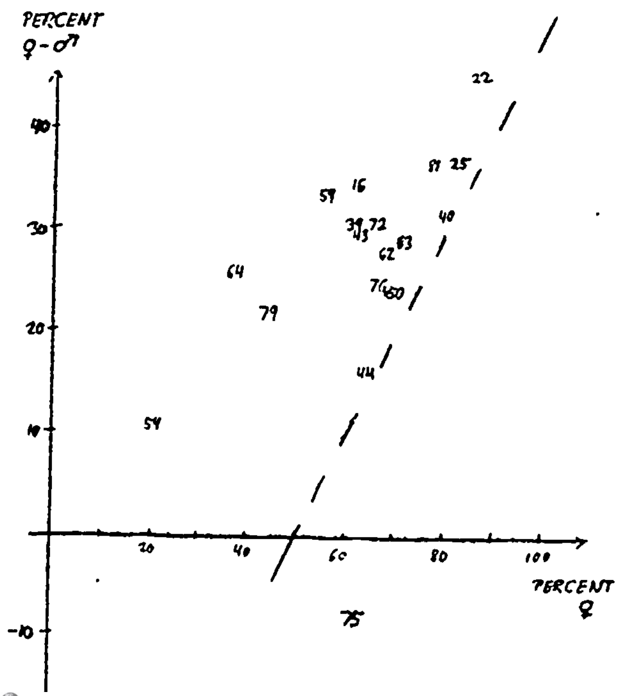
GRAPH B.7

BOYS NEED TO KNOW MORE MATH
PERCENT DISAGREE AND STRONGLY DISAGREE
POP A



GRAPH B8

MEN BETTER SCIENTISTS AND ENGINEERS
PERCENT DISAGEE AND STRONGLY DISAGREE
POP A



GRAPH B9

WOMAN NEEDS CAREER AS MUCH AS A MAN
PERCENT AGREE AND STRONGLY AGREE
POP A