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GENDER AND ACADEMIC ACHIEVEMENT IN MATH
An Examination of the Math Performance Data on Seven to Nine Year Olds in Trinidad and Tobago[1]

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There is general concern in Trinidad and Tobago and the wider English-speaking Caribbean about the gender differential in performance on regional and national examinations. Previous studies had shown boys not performing as well as girls. Utilizing scores from the math component of the Continuous Assessment Programme (CAP), this study investigated whether the trend was evident among the younger primary school students. The final sample comprised 1,682 students in Standard 1, Standard 2, and Standard 3 (age group 7-9 years). Total scores, Zscores, scores for students attempting all items, and composite scores for the low-level and high-level items were computed. The proportion of boys and girls in the upper ($z \geq 1.00$) and lower ($z \leq -1.00$) tails of the distribution were examined, as was the gender differential in the number of students omitting test items. Overall, girls scored higher than boys, more boys than girls omitted items, and a significantly greater proportion of boys were in the lower tail of the distribution. The Hindu schools were the exception to this general finding. The non-response to items could be addressed by schools teaching test-taking skills. However, more important may be the underlying reasons for the phenomenon, and the implications for boys' future academic achievement and employment opportunities.

From the 1970s to the present, the debate on sex-related differences in academic achievement has continued unabated. However, while the differential academic outcomes have remained a focus of published research, the emphasis has shifted from the performance of girls in the separate sciences and higher-level mathematics to the academic achievement level of boys.

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Previous research had found that to varying degrees boys consistently scored higher than girls on a number of indicators of mathematical proficiency, resulting in boys' better performance in higher-level mathematics (Fennema & Peterson, 1985; Leahey & Guo, 2001; Manning, 1998; Peterson & Fennema, 1985; Randhawa, 1991, 1994). However, cementing these findings were Hyde, Fennema, and Lamon's (1990) meta-analysis on gender differences in mathematics performance, and the 1992 report of the American Association of University Women (AAUW). These studies had a profound impact on pedagogical approaches and overall classroom environment, resulting in increased attention to the mathematical achievement of girls, and the active adoption of policies to support and encourage girls in the study of mathematics.

Challenging the perceptions of male mathematics superiority, Hyde et al. (1990) and Leahey and Guo (2001) argued that it is misleading to assert an evident gender difference in mathematics achievement favouring males. At the primary level, existing differences were not consistent across mathematics skill areas, and where differences existed they were small but in favour of girls. However, their data did substantiate the perception of male superiority in mathematics at the secondary level, indicating that in the areas of problem-solving (Hyde et al., 1990) and reasoning skill and geometry (Leahey & Guo, 2001), there were slight consistent advantages in favour of boys.

Despite the above statements, there remains a growing concern over the academic performance of boys—a concern that is also the subject of intense debate in Britain. The Office for Standards in Education (OFSTED) in its 1996 report "The Gender Divide: Performance differences between boys and girls in school" stated that girls out-performed boys at ages 7, 11, and 14 in English, and were similar in performance in mathematics and science on the National Curriculum Assessment (NCA). On the General Certificate of Secondary Education (GCSE) examinations taken at 16+, their performance remained superior to that of the boys, achieving more grades at A* to C, and showing success even in the traditional male subject areas. The only area of boys' dominance was GCSE physics, the subject area in which boys also did better on the NCA.

Younger, Warrington, and Williams (1999) caution that in discussing the sex-related differentials in academic performance, it is possible to overlook the rising achievement levels of both boys and girls. But, as can be gleaned from the headline of the August 22, 2002 BBC World Edition "Addressing the gender gap: What's to be done about the boys?" the academic performance of the male student has become one of the central issues in the discourse about education in the UK. The results of the 2002 GCSE show that girls beat the boys by 9 percentage points at the top grades; the gap ranging from 14.3 percentage points in French and Spanish to 1 percentage point in mathematics. The only two areas in which boys did better than girls were physics and biology (0.7 and 0.8 percentage points respectively). Whether these results represent an increasing achievement gap (see Gorard, Rees, & Salisbury, 1999), there is no denying the existence of a performance differential, which must be of concern to the educational community and the society as a whole.

Although the cultural setting may be different, and the resulting dynamics may contrast with those common to the traditional settings of the more developed Western societies, the issue of performance differential is also the subject of active debate in the English-speaking Caribbean (Caribbean Education Task Force, 2000).

The Trinidad and Tobago Context

In Trinidad and Tobago, as in the wider English-speaking Caribbean, on average children start primary schooling at age 5. After two years in the Infant department they proceed to Standard 1 (Std. 1), moving up each subsequent year until Std. 5 where they take the Secondary Education Assessment (SEA) examination, the results of which are the main criteria for accessing the stratified secondary education system.

The public primary education system consists of government funded and managed non-religious schools, and others that are two-thirds government funded but denominationally managed. Parental choice of school is based on the family's religious affiliation, proximity of the school to the home or place of employment, and reputation of the school (for example, the number and quality of the secondary school placements gained on the SEA).

As stated in the *Caribbean Education Strategy*--the report of the Caribbean Education Task Force (2000)—there is general concern in the English-speaking Caribbean over the low academic achievement of students in the region. This low academic achievement is reflected in the unacceptably "high drop out rates beyond [age 15] the age of compulsory education" (p. 9), and poor performance of too high a percentage of students on the examinations of the Caribbean Examinations Council (CXC)—the Caribbean equivalent to GCSE—taken in Form 5, which roughly corresponds to Grade 11 in the US system. The report, in citing national and Caribbean-wide data, states that on completing primary school, 25% to 30% of students do not acquire the basic cognitive skills to benefit from education at the secondary level. Additionally, of the students who complete the secondary cycle, only about 30% achieve a level that allows access to education at the tertiary level.

But the problem of low academic achievement is not limited to performance at the CXC level. Commentaries in the Trinidad and Tobago daily newspapers (Baldeosingh, 2003; Ramcharitar, 2003) situate the problem as a manifestation of the core issue of the quality of public primary education. For example, Morgan Job comments in the *Trinidad Guardian* (June 19, 2003) that, "of 120 children placed in Form 1 in a state [secondary] school in Tobago in 1994, 115 scored less than 50 per cent in English and math" on the Common Entrance Examination (CEE), now the SEA. Because of the selective purpose of the examination, such an occurrence would not apply to all secondary schools receiving students transiting the primary system. Nevertheless, these figures are not encouraging and do present a reason for concern.

Within this concern is a subcomponent of equal importance: the gender differential in academic performance as evidenced by scores on mandated exams (Kutnick, Jules, & Layne, 1997; Parry, 2000). However, the issue of male underachievement is not a recent concern. As stated in the conference report, *Addressing Male Underperformance in the Education System: Intervention Strategies* (Trinidad and Tobago [T&T]. Ministry of Education, 1997), the "Male Identity Crisis in the Caribbean" and the resulting disengagement from the education process were brought to public attention by Miller in 1986 (p. 3). Using Miller's work as a frame of reference, the conference report observed that perhaps, in addressing in the society "issues of inequality with regard to females … the pendulum had swung too far from them [the males] resulting in the disequilibrium that was being observed in terms of male identity and achievement" (p. 3). The continued debate indicates that from 1986 to the present, the issue has defied resolution.

With reference to Trinidad and Tobago, Jules and Kutnick (1990) and Kutnick and Jules (1988) stated that a gender differential in academic performance is reflected across all curriculum areas. Girls perform better than boys on teacher-made tests at all ages between 8 and 16, and in all curriculum subjects. They achieve better results on the SEA, and also achieve better results on the CXC examinations across all subjects including subjects within the differential sciences (Kutnick et al., 1997). However, contrasting with this general finding, Jules and Kutnick (1990) noted that on the CXC, Muslim boys performed better than Muslim girls overall and in social studies.

A review of the 2000, 2001, and 2002 CXC O'Level General Proficiency results for Trinidad and Tobago (T&T. Ministry of Education. Division of Educational Research and Evaluation, 2004) gives general support for the finding that girls are academically outperforming boys; however, this does not hold true for mathematics. In 2000, 2001, and 2002, a higher proportion of girls than boys attained Grades I – III—the grades normally accepted as passing grades—in integrated science, chemistry, and physics. In 2001, boys did better in biology; however, the proportion of girls getting Grade I exceeded that of boys. The pattern of girls' academic dominance was evident in almost all other subject areas including technical drawing and information technology. The disproportion in the number of girls to boys in the technical subject areas did not allow for valid comparisons; however, the few girls who sat the Technical Proficiency examinations performed as well as, and in some cases better than, the boys. The only subject area in which boys consistently did better than girls was mathematics. In 2000, of the students who sat mathematics at the General Proficiency level, 47.4% of boys to 44.9% of girls earned Grades I-III; in 2001, the proportion was 44.8 to 43.4; and in 2002, there was a general improvement with the proportions increasing to 52.5 and 50.1 respectively.

It is important to note that mathematics is compulsory for all students and there are approximately equal numbers of boys and girls at the secondary level [data retrieved from the Division of Educational

Research and Evaluation, Dec. 2004]. However, of the students taking mathematics at the General Proficiency level, girls comprised 58.3% in 2000, and 58.1% in 2001 and 2002. This suggests that a higher percentage of girls than boys are doing General Proficiency level mathematics and, alternatively, a greater percentage of boys are doing the Basic Proficiency level mathematics. Therefore, it is possible that the better performance of boys may be masking the issue of gender differentials in the students taking the General Proficiency examinations as against the Basic Proficiency examinations. While this may be so, the finding with regard to boys' mathematics performance gives support to the claim that boys perform better in higher-level mathematics (Fennema & Peterson, 1985; Leahey & Guo, 2001; Manning, 1998; Peterson & Fennema, 1985; Randhawa, 1991, 1994). However, it does not invalidate the overall concern about boys' performances, or the differential performance on the SEA.

There are many explanations offered for this difference in performance. Specific to the Caribbean, these range from Miller's (1986, 1994) theory of place in the marginalization of the black male, to differences in the classroom experiences of boys and girls (Kutnick et al., 1997; Parry, 2000), to male socialization and cultural expectations of male behaviour which conflict with the ethos of the school (Chevannes, 2001; Parry 2000), to the traditional independence of Caribbean women, and historic male privileging of which male educational underachievement has been an "ironic outcome" (Figueroa, 1997, p. 68).

Many Caribbean scholars have argued that the contrasting expectation and socialization have better prepared girls for performing in the modern school (Chevannes, 2001; Parry, 2000). Conrad's (1999) interview of a Caribbean female educator supports this assertion. As stated by the interviewee with reference to her childhood, unlike her brothers, a significant amount of her time was spent on home management responsibilities, supporting her mother. And again, unlike her brothers, she was not supposed to play much, but apply herself to her schoolwork and be obedient.

While the above arguments address important considerations, the extent to which these factors explain group variance in student academic performance is subject to continuing research. Nevertheless, they provide plausible starting points and directions for interrogating and illuminating the issue of gender differential in academic achievement.

With the exception of Kutnick and Jules (1988), all other studies on Trinidad and Tobago student performance at the primary level that I have reviewed have used scores on the CEE as the principal measure of student academic achievement. A consequence of this fact is that conclusions are based on the performances of the 11- and 12-year-old cohort at the end of their primary school experience, and do not give an insight into the academic performances of boys and girls at the lower levels.

In 2000, as part of an overall strategy to address educational standards, the Ministry of Education (MOE) piloted the Continuous Assessment Programme (CAP), a national assessment scheme which assesses all students in Std. 1, Std. 2, and Std. 3 (ages 7, 8, and 9) in the curriculum areas of reading, English, and math. This study utilizes the individual student scores on the mathematics component on the 2001 CAP at Std. 1, Std. 2, and Std. 3 as the measure of achievement to determine whether the findings of previous studies are replicated across this age group.

This study, in acknowledging the findings in the literature of the more developed countries, that at the lower primary level there are no significant differences between boys and girls' mathematics achievement, and supporting that ideally this should be the reality, also acknowledges the contrasting findings of Kutnick and Jules (1988). Of interest, therefore, is whether there is a significant difference in academic performance between girls and boys in Std. 1, Std. 2, and Std. 3 on the mathematics component of the CAP, and whether this difference, if there is one, is a reflection of differential performance based on item level difficulty.

Recognizing that there may be fundamental differences in performances between high-scoring and low-scoring students, the study also compares the performance of boys and girls classified as high-scoring and low-scoring. Furthermore, being cognizant of the importance attached to type of school (denomination) in the Trinidad and Tobago context, the study examines the relationship between type of school and girls and boys performance in mathematics. Also, in recognizing socioeconomic status as an important predictor of student academic performance, the study seeks to determine whether there is a significant difference in academic performance between girls and boys across different socioeconomic groupings.

An initial perusal of the math score sheets indicated that a number of students omitted items. There is a direct relationship between the number of items attempted and the probability of an individual achieving a higher final score. With this is mind, I examined whether there is a significant gender differential in the number of non-responses to items on the assessment.

Method

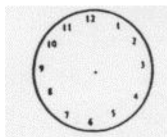
Instrumentation

The CAP mathematics for Std. 1 consisted of 20 items with a total score of 40. The content breakdown of the problems was: number (8 items), measurement and money (7 items), geometry (2 items), statistics (3 items). The Std. 2 instrument also consisted of 20 items but with a total score of 60. The content breakdown was: number (11 items), measurement and money (5 items), geometry (2 items), statistics (2 items). The Std. 3 instrument was out of a total score of 70 and comprised 22 items, with the following content breakdown: number (11 items), measurement and money (5 items), geometry (3 items), statistics (3 items). While the MOE did pay attention to total class by school score in each category, overall interest was in total score on the assessment.

Using Carpenter et al.'s definitions of item difficulty level (Peterson & Fennema, 1985) as a guide, the items were classified as either low-level (LL) or high-level (HL). LL items assessed knowledge and skills, and HL items assessed reasoning and application. Thus, LL mathematics problems required students to recall facts, or perform the steps involved in a mathematical procedure that did not require interpretation or demonstration of conceptual understanding through application and knowledge transfer (see Figure 1). Classification of items was conducted with the assistance of two mathematics teachers, with the final placement of items being based on 100 percent agreement.

Low-level Items

1. Asaph left home at 6:55 a.m.
   a. Draw in the hands on the clock below to show the time Asaph left home.



   b. Asaph took 20 minutes to get to church.
   At what time did he get to church?

   Answer ____________________

2. I had 64 marbles.
   I gave Sue 26 marbles.
   I have _______________ marbles left.

3. Write the numbers below in ascending order.

   472 299 901 406

   Answer________________________

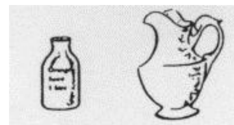
4. Write <, >, or = in the boxes to complete the number sentences correctly.

   6051 □ 6510

   9909 □ 9099

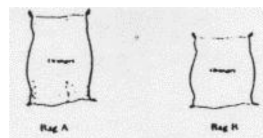
High-level Items

1. The bottle below holds 1 litre of juice.
   The jug holds 3 times as much as the bottle.



   How many litres will it take to fill the jug?
   Answer ______________________

2.

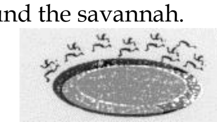


Bag A has 245 oranges. Bag B has 138 oranges. How many oranges must be added to Bag B so that both bags have the same number of oranges?
Answer ________________________

3. Write in the boxes the missing numbers.

   64 x 18
   = 64 x (□ + 8)
   = (64 x □) + (□ x 8)

4. A class decided to raise funds for a sick child.
   Each student was paid $4 for a lap around the savannah.



If 35 students ran 1 lap around the savannah, how much money did the class raise?
Answer________________________

Figure 1. Examples of low-level and high-level math items.

Sample

From the CAP score sheets available at the time from the MOE, 25 primary schools stratified by gender (boys, girls, or coeducational), school type (government non-religious, denominationally managed, private, and other), location (urban, sub-urban, and rural) and socioeconomic status (SES) were randomly selected to provide the sample for this study. SES is a school level variable. Principals and teachers of the selected schools were asked to define the SES of the school as upper, upper-middle, middle, lower-middle, or lower based on their perception of the socioeconomic status of the majority of the children attending the school. Two schools were classified as other, which were both small and managed by Christian denominations other than those identified in the study.

Of the 25 schools, 3 schools omitted three or more items in a class, and 2 schools did not accurately follow the scoring guide on the tests. Thus 20 schools provided the final sample. The sample comprised 1,682 students (f = 789, 46.9%; m = 893, 53.1%). Of this sample, 605 were in Std. 1 (f = 267, 44.1%, m = 338, 55.9%); 615 in Std. 2 (f = 290, 47.2%, m = 325, 52.8%); and 462 in Std. 3 (f = 232, 50.2%, m = 230, 49.8%). There is system degradation in the number of males from Std. 1 to Std. 3. The results of chi-square analyses indicate that these proportional differences could be attributed to chance. All data were retrieved from the score sheets housed in the MOE.

Data analysis

Chi-square statistics were calculated to determine whether the number of students omitting one or more items on the assessment differed significantly by gender. To test whether students' performances differed by gender, means comparisons were run on total scores, on scores of students attempting all items, and composite scores for the low-level and high-level items. Because the total score differed by class level, I computed standard deviated scores for each class level, thus allowing for valid comparison of students across levels. Recognizing that small mean differences between groups do not preclude the existence of large differences in the tails of the distribution (Halpern, 2000), the chi-square analysis was computed to determine whether the observed frequencies of boys and girls in the high-scoring and low-scoring groups were consistent with the proportion of girls and boys in the sample. Additionally, ANOVAs were computed to examine academic performance between girls and boys across type of school and the different socioeconomic groupings. Significance is determined at the .05 level of probability and, in addition, indices of Strength of Association are reported for all comparisons.

Results

Chi-square results for non-responses

There was a total of 786 items not attempted by students. Of these items, 327 can be attributed to girls and the remaining 459 to boys. This difference was significant at the .01 level, $(\chi^2(1, n = 786) = 8.86, p < .003)$, d = 0.22. Adding to the significance of this discrepancy, from one particular lower-income girls' school, all 17 students in Std. 1 omitted items 19 and 20, the 15 students in Std. 2 omitted item 20, and all 17 in Std. 3 omitted item 22. Despite including these classes, boys still omitted more items than expected by chance.

A total of 373 students were responsible for the 786 items omitted. Of these, 153 were girls comprising 19.4% of female students in the sample, and 220 were boys comprising 24.6% of the male students. The result of the chi-square was significant, $\chi^2(1, n = 373) = 5.21, p < .023$, d = .24, with boys being over-represented. Testing frequency differentials at the various class levels revealed that whereas there was no significant association between gender and the number of students omitting items in Std. 1 and Std. 3, the difference in Std. 2 was significant, $\chi^2(1, n = 119) = 4.16, p < .05$, d = .39. However, in all instances, for the boys the observed frequencies for non-attempts were higher than the expected frequencies.

Chi-square results for proportions in the tails of the distribution

Examining the proportion of boys and girls in the upper (z ≥ 1.00) and lower (z ≤ -1.00) tails showed in Std. 1, 18.7% of girls (n = 50) and 14.8% of boys (n = 50) were in the upper tail (z ≥ 1.00, raw score ≥ 37), $\chi^2(1, n = 100) = 1.46, p > .05$, d = .24. In Std. 2, 102 students scored above 1 standard deviation (raw score ≥ 50; n = 51 girls, 17.6%;

and n = 51 boys, 15.7%), and 89 students did likewise in Std. 3 (raw score ≥ 52; n = 47 girls or 20.4% and n = 42 boys or 18%). All chi-square results were non-significant.

The results for the proportion of boys to girls scoring z ≤ -1.00 indicated a significant number of boys were in the lower tail of the distribution. In Std. 1, 13.5% of girls, n =36 and 22.2% of boys, n = 75 scored at or below z = -1 (raw score ≤ 8), $\chi^2(1, n = 111) = 6.03, p < .02$, d = .51. Similarly in Std. 2, 11.4% of girls, n = 33 and 23.4% of boys, n = 76, boys scored at or below z = -1 (raw score ≤ 18), $\chi^2(1, n = 109) = 12.24, p < .001$, d = .77. In Std. 3, 14% of the girls (n = 32) and 20% of boys (n = 46) were in the lower tail (raw score ≤ 22). However, while the effect size approached a moderate association between student gender and the probability of being in the lower tail of the distribution, the chi-square test was not statistically significant, $\chi^2(1, n = 78) = 2.51, p > .05$, d = .37.

Means comparisons results

The first comparison used standard scores of the total sample as the dependent variable. Levene's test indicated the distribution of scores for girls and boys was heterogeneous; therefore t with adjusted degrees of freedom was used in the interpretation of the results. The result of the t-tests evidenced girls' significantly higher performance on the CAP, t (1680) = 4.42, p < .001, d = .22. A 2 (gender) x 3 (class level) analysis of variance yielded a significant F statistic for the main effect of gender, but non-significance for class level and the interaction effect between the two variables. However, unequal samples coupled with heterogeneity demand very cautious interpretation of F. To determine the extent of the gender differentials at the class level, I conducted a number of t-tests tests, and being cognizant of the increased probability of Type 1 error, set alpha at .015.

At the Std. 1 and Std. 2 class levels, there was statistically significant evidence that girls performed better than boys, t (603) = 2.94, p = .003, d = .24, and t (613) = 2.91, p = .003, d = .24. The same did not hold for Std. 3, t (460) = 1.68, p > .05, d = .16. Because a greater proportion of boys than girls omitted items, and the ratio of boys and girls to number of items omitted was also greater for boys, t- tests were run on standard scores to observe whether the mean math scores differed for those who completed all the items. The removal of non-responders from the analysis had the additional benefit of making the groups homogenous. The result was statistically significant, but suggested the effect of gender on math performance was at best weak, t (1307) = 2.45, p = .015, d = .14. Further examination of mean comparisons at the class level showed non-significant differences in Std. 2 and Std. 3, p > .05, but approached significance in Std. 1, t (461) = 2.25, p = .025, d = .21 (see Table 1).

Table 1. t-Tests: Gender Differences

	Girls		**Boys**			
Samples	**M**	**SD**	**M**	**SD**	*t*	*d*
Total sample [a]	0.11	0.94	-0.10	1.04	4.42**	0.22
All attempts [a b]	0.07	0.97	-0.07	1.03	2.45*	0.14
			Class			
Std 1 [b]	30.52	7.54	28.87	8.12	2.25*	0.21
Std 2 [b]	38.11	13.30	37.19	14.08	0.74	0.07
Std 3 [b]	39.17	14.27	37.81	14.87	1.27	0.14
			High Level Items			
Total sample [a]	0.11	0.94	-0.10	1.04	4.36**	0.21
All attempts [a b]	0.26	0.89	0.13	0.97	2.49*	0.14
Std 1	10.08	3.52	9.34	3.79	2.46*	0.20
Std 2	20.96	7.80	18.46	9.57	3.56**	0.29
Std 3	18.72	7.98	17.67	8.16	1.40	0.13
			Low Level Items			
Total sample [a]	0.10	0.96	-0.09	1.03	3.75**	0.18
All attempts [a b]	0.24	0.92	0.14	0.95	1.84	0.10
Std 1	18.46	5.36	17.18	5.65	2.83**	0.23
Std 2	15.00	6.68	14.00	7.34	1.76	0.15
Std 3	19.38	7.11	18.11	7.52	1.86	0.17

[a] Standard scores. [b] Non-responses are omitted. All other means are raw scores
* p< .05. ** p< .01

Gender differences by item difficulty

Examining math scores based on the difficulty level of the item, the statistical evidence showed that the girls performed significantly better than the boys on both the high-level items, t (1680) = 4.36, p < .000, d = .21, and the low-level items, t (1680) = 3.75, p < .000, d = .18. A further examination of performance differentials at the class level showed significant differences in favour of girls in Std. 1, t (603) = 2.46, p = .014, d = .20 for high-level items, and t (603) = 2.83, p < .005, d = .23 for low-level items. In Std. 2, significance was found only on the high-level items, t (613) = 3.56, p < .001, d = .29, while in Std. 3, there was no statistically significant difference between the performances of girls and boys (see Table 1).

Differences by type of school

A factorial ANOVA was conducted to examine mean differences in math scores in relation to the type of school the student attended. Three RC schools were included in the data. Of these, two were single-sex schools—one upper-middle SES boys' school and one lower SES girls' school--and the other, a small lower SES rural co-ed school with data for Std. 1 and Std. 2 (n =38). In addition to the fact that the two single-sex schools represented markedly different socioeconomic backgrounds, all the girls in the single-sex school did not give responses to the final items. As a result, including the RC schools in the analysis would have been, in reality, a comparison of mathematics performance between two inherently different populations. Therefore, to control for the confounding effects of socioeconomic status, the Catholic schools were excluded from this analysis.

The factorial ANOVA yielded significant F statistics for the main effects of gender and type of school, and the interaction effect. As indicated by the adjusted R^2, 18.8% of the variance in math is predictable from the two independent variables. The test of the simple main effects showed significant differences in performance in the Anglican schools, F(1, 196) = 16.56 p < .001, d = .58; the Presbyterian schools, F(1, 360) = 14.85 p < .001, d = .40; and the government schools, F(1, 208) = 13.91 p < .001, d = .51; but non-significance in the Muslim schools, F(1, 245) = 2.05 p > .05, d = .18; the Hindu schools, F(1, 350) = .032, p > .05, d = .02; the private school, F(1, 57) = 1.85 p > .05, d = .34; and schools designated other, F(1, 98) = 1.71 p > .05, d = .26 (see Figure 2).

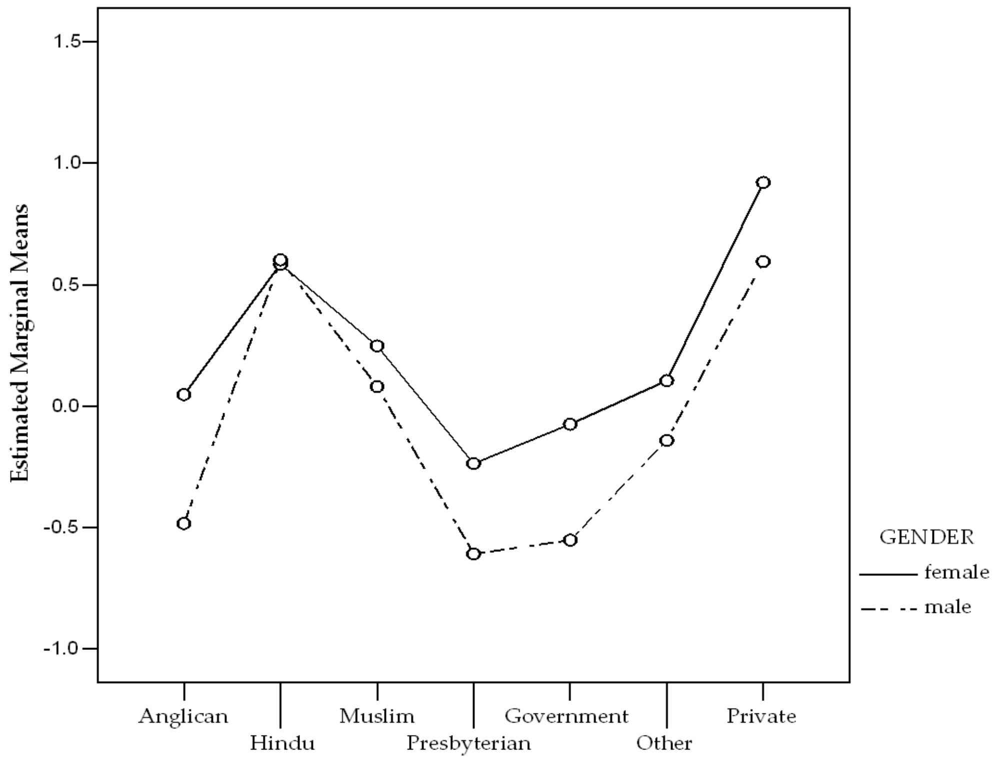


Figure 2. Plot of means for type of school by gender. RC schools excluded.

The results for Hindu schools were not surprising. Previous analysis had shown a reduced probability of significant mean score differences between students who attempted all items. Of the 352 students in the Hindu sample (f = 166, m = 186), only 8 students (f = 3, m = 5), or 2.27% omitted items. The difference was trivial.

Gender comparisons by SES

The final analysis examined mean math scores by gender and SES. The sample contained one school--a private school, n = 59--which could be classified as upper SES. Despite this limitation, it could be argued that the school and students are typical of the schools in Trinidad and Tobago that fall into that socioeconomic category. Therefore, these data are included in the analysis.

The main effects of gender and SES, and the interaction effects are all significant at $p < .01$ level. An examination of the means indicate that whereas the girls' overall performance was significantly better than the boys, and both groups did better as SES increased, the level of significance varied as a function of the SES of the school. As indicated by the simple main effects, there were statistically significant differences at the lower income, $F(1, 558) = 52.42$, $p= .000$, $d = .61$, and upper-middle income levels, $F(1, 480) = 7.41$, $p= .003$, $d = .25$, but not at the lower-middle and upper income levels, $F(1, 480) = 3.23$, $p > .05$, $d = .15$ and $F(1, 57) = 2.13$, $p> .05$, $d = .38$, respectively. Note, however, that at the upper income level, the effect size of .38 approaches a moderate difference in math achievement between boys and girls.

Discussion

In keeping with the findings of Jules and Kutnick (1990) and Kutnick and Jules (1988), the evidence suggests that girls' overall performance on the mathematics component on the CAP is significantly better than that of boys. With the exception of the Hindu schools in which differences were trivial, in all other comparisons girls had higher means.

The data did not allow for an examination of partially correct items, and so it could not be determined whether the items boys omitted were those for which girls were awarded partial marks. To educators, the number of non-attempts would be discomforting, and of equal concern would be the disproportionate number of boys compared to girls who fell into this category. Accentuating this concern would be the fact that in one school, all 49 girls either did not attempt the final items or the scores were not recorded.

The statistically significant disparity between the genders on the probability of omitting an item may be reflecting a difference in the level of persistence between the boys and girls resulting from male socialization practices, alluded to by many Caribbean researchers (see Chevannes, 2001; Figueroa, 1997; Parry, 2000). Once again, these results do not apply to the Hindu schools. Although in the Hindu schools gender differences in mathematics performance were not significantly different, with regard to the effect of type of school on student performance, these data do not allow for a valid interpretation of the results. In Trinidad and Tobago, in the case of the Hindu population, and to a lesser extent the Muslim population, religion can be used as a proxy for race/ethnicity, and thus race/ethnicity confounds the contribution of type of school. More than 90% of students in Hindu schools and 99% of the teachers are Indo-Trinidadians of East Indian descent. Yet, while there may be valid explanations for this finding, among the questions researchers would need to examine is whether the students' performances are the result of school input, or some aspect of the Indo-Trinidadian culture that facilitates parity in the performance of girls and boys.

A limitation of the study is in the classification of SES. In the absence of contextually relevant measure, schools were classified based on the perceptions of the principal and teachers. Also, the only private school in the sample was the only school in the upper socioeconomic bracket. In Trinidad and Tobago, this occurrence is not unique. Almost all regular education primary private schools cater to an upper-middle, or upper socioeconomic population. Accordingly, examining mean differences by gender in the private schools is synonymous with testing the performance differences between girls and boys classified as upper-middle to upper SES. This fact does not invalidate the results. However, it qualifies the discussion on the contribution of type of school to the math performances of girls and boys at the primary level.

Looking at the tail ratios, a higher but non-significant proportion of girls to boys scored in the upper tail, while a significantly larger proportion of boys was in the lower tail of the distribution. Again there is the evidence of the continuing disparity between the genders with regard to mathematics performance, and again the implications as previously discussed would apply.

Conclusion

The findings in this study mirror many of the findings in the literature. Overall, girls did better than boys on the mathematics component on the CAP; the reported effect size statistics, in most instances, indicate weak to medium effects. In contrast to this general finding is the strength of the proportional difference in the representation of girls and boys in the lower tail of the distribution ranging from d = .37 to d = .77. While one might argue that the mean gender difference in math performance is small, this argument masks the disproportionate number of boys found in the lower tail of the distribution. This number is a source of concern, and certainly challenges the education system to address this imbalance.

With regard to the relevance of effect sizes to the importance of the findings, Cohen contends that depending on the context, even a small effect can be of critical importance. Agreeing with Cohen's view, the differential performance between students, although small in effect, translates into a disparity of thousands of male students. This gap in performance between the genders, unless addressed, has implications for later student placement at the secondary level.

In Trinidad and Tobago, while all students are guaranteed a place at the secondary level, the point at which they access the highly stratified secondary system is predicated on their performance on the SEA. There is a direct relationship between the type of secondary school attended and future academic achievement and employment. Thus the higher mean achievement of girls and, just as important, the significantly disproportionate number of boys in the lower tail of the distribution, portend to fewer future job opportunities for boys and fewer boys than girls accessing the tertiary education system,

The evidence indicates a greater tendency by boys to omit items, resulting in them negating the possibility of getting marks for partially correct items. Acknowledging the explanations proffered for this phenomenon, and the need for further research into the sociological and psychological factors, from a practical perspective, this is a test-taking strategy that can be taught at the class level. Any attempt at improving the performance of the boys must address this issue of omitted items.

This study does not suggest a shift in focus away from the girls. On the contrary, there needs to be more critical examination of school and classroom processes, girls' and boys' attitudes towards studying, their differences in persistence and goal orientation, and a number of other societal variables that influence student academic achievement. This is necessary in order to disentangle the factors that impact one group more than the other. In this way, as the education system aims for parity between the sexes, the focus would be on improving the academic achievement of both girls and boys.

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