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Gender differences in homework and test scores in Mathematics, Reading and Science at tenth and twelfth grade

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Abstract

Gender differences in maths, reading, science and the amount of homework done out of school were obtained for tenth and twelfth graders from the American National Educational Longitudinal Study. Males obtained significantly higher mean scores in maths and science, and females obtained significantly higher mean scores in reading and amount of homework. There were significant correlations between test scores and amount of homework, suggesting that amount of homework contributes to test scores.

Keywords: gender differences, maths, reading, science, homework

Introduction

One of the issues with which the evolutionary psychology of gender differences has been concerned is the relative strengths of males and females on cognitive abilities and academic performance in schools and universities. It has been widely found that females tend to perform better in course work

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and examinations than would be predicted from their scores on tests of aptitude, intelligence or knowledge. In the United States it has been found that females obtain better average college grades than would be predicted from their SAT (Scholastic Aptitude Test) scores (Linn 1990; Young 1991, 1994). Among high school students males tend to perform better on tests in mathematics but females tend to do better on grades (Kimball 1989). In a twenty-six-nation study of the historical knowledge and grades of 15-year-olds, it was found that boys obtained higher scores on knowledge in all countries but girls obtained higher grades in nineteen of the countries (Wilberg and Lynn 1999).

There are two plausible hypotheses for the explanation of this gender difference in test scores and grades/examinations. The first is that females have a stronger work ethic than males which motivates them to expend greater effort on course work and preparation for examinations. The stronger work ethic of females was found in studies by Spence and Helmreich (1983) of American college students, academic psychologists and business people. This result has been confirmed in a study of college students in forty-three countries, in thirty-five of which females had higher mean work ethic scores than males (Lynn 1991). Further studies finding stronger work ethic in females have been reported in the United States by Farmer (1983), Nevill and Perotta (1985), Nevill and Super (1988) and Luzzo (1994) and in South Africa by Watson and Steed (1990).

A second plausible hypothesis for the better performance of females on course work and grades is that females are better at spelling and grammar and have generally better essay-writing skills than males, as shown in the meta-analysis of gender differences in verbal abilities carried out by Hyde and Linn (1988). These essay-writing skills are frequently not adequately measured in tests of verbal abilities, so that females have better verbal cognitive abilities than are typically picked up by tests.

The explanations of these gender differences in terms of evolutionary psychology have recently been discussed by Geary (1998). He proposes that girls have evolved strong verbal abilities to enable them to compete effectively in female–female competition and in order to counter the male advantage in physical strength in their relationships with men. He proposes that the male advantage in mathematics is a secondary effect of stronger spatial abilities which evolved in males because they were required for hunting, which evolved as a male specialism during the evolution of *Homo sapiens*. Although Geary notes that in contemporary societies females tend to get better grades for course work, he does not offer an explanation for this advantage in terms of evolutionary psychology.

The present study is designed to provide further evidence on the gender differences in cognitive abilities and course work and in particular to examine the contribution of gender differences in the amount of time devoted

to homework. The hypothesis is that because of their stronger work ethic girls are likely to do more homework than boys and that this is likely to be a factor contributing to their higher grades.

Method

The data for this study have been obtained from the American National Educational Longitudinal Study (NELS) of 1988. This study consists of a nationally representative sample of tenth-grade school students tested in 1990 on maths, reading and science and retested at twelfth grade in 1992. The school students were asked to provide an estimate of the number of hours per week of homework they did out of school. The sampling of the NELS was carried out by the selection of a stratified sample of 1,052 schools and selecting random samples of twenty-five students from each school. The school sample was stratified by size, urban versus rural, region and percentage of minority students. The numbers in the sample consist of 1,406 Asians, 14,024 whites, 2,922 Hispanics and 2,260 African-Americans. The sampling procedures are described in detail in the report of the National Center for Educational Statistics (1991).

Results

Table 1 shows the means and standard deviations of males and females on the tests of maths, reading and science and of the weekly hours of out-of-school homework. The statistical significance of the male–female differences was tested by analysis of variance. It will be noted that boys obtain higher mean scores than girls on the tests of maths and science, while girls obtain higher scores on reading than boys and do more homework.

Table 1 Mean scores for Mathematics, Reading, Science and hours of homework by gender

		Males		*Females*		
Variables	*Grade*	*M*	*SD*	*M*	*SD*	*F-values*
Maths	10	50.36	10.25	49.95	9.86	5.51*
Reading	10	49.29	10.19	51.07	9.69	106.66***
Science	10	51.50	10.42	48.88	9.35	230.68***
Maths	12	50.61	10.12	49.82	9.84	16.92***
Reading	12	49.27	10.17	51.39	9.51	126.46***
Science	12	51.55	10.20	48.80	9.49	210.51***
Homework	10	2.22	1.62	2.65	1.72	225.99***
Homework	12	3.13	2.01	3.58	1.92	154.70***

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

It is an interesting question whether the amount of homework is associated with test scores. To examine this relationship, correlations were computed between test scores and homework for males and females separately. The results are shown in Table 2. It will be seen that test scores are positively correlated with homework in all cases, and that these correlations are consistently and significantly higher for females than for males.

It is useful to ascertain whether gender and homework are individually significant and mutually independent determinants of test scores. To do this, a multiple regression was run using the enter method with homework entered first in the regression followed by gender. The significance levels associated with the standardised Beta and R square change were adjusted for design effect. The results of the multiple regression are presented in Table 3. They show that homework and gender are independent and statistically significantly associated with test scores.

Table 2 Pearson correlations among Mathematics, Reading, Science and hours of homework by gender

	Homework 10			*Homework 12*		
Variables	*Male*	*Female*	*t*	*Male*	*Female*	*t*
Maths	0.28**	0.36**	4.0****	0.22**	0.28**	3.0***
Reading	0.25**	0.32**	3.5***	0.17**	0.22**	2.5**
Science	0.23**	0.30**	3.5***	0.17**	0.22**	2.5**

**p <0.01; ***p <0.001; ****p <0.0001.

Table 3 Predictions of academic achievement by gender

	Grade 10			*Grade 12*		
Predictors	*Beta*	*t*	*R^2 change*	*Beta*	*t*	*R^2 change*
Maths						
Homework	0.321	37.47***	0.098***	0.248	24.87***	0.058***
Gender	−0.066	−7.70**	0.004***	−0.068	−6.77**	0.005***
Reading						
Homework	0.281	32.47***	0.083***	0.194	19.31***	0.042***
Gender	0.052	5.77*	0.002***	0.087	8.61***	0.007***
Science						
Homework	0.265	30.64***	0.059***	0.194	19.35***	0.030***
Gender	−0.169	−19.62***	0.028***	−0.171	−17.05***	0.029***

*p <0.05; **p <0.01; ***p <0.001.

Discussion

The study contains five principal points of interest. First, the hypothesis that girls do more out of school homework than boys is confirmed at both 10th and 12th grade. It should be acknowledged that the amount of homework was measured by self-report and could be inaccurate. It is possible that those who do well on tests claim to do more homework but do not in fact do so. There is no way of testing this possibility in the data set analysed in this paper and we proceed on the assumption that the self-reported gender difference is genuine. The result that girls report doing more homework than boys is consistent with the stronger work ethic of females for which the evidence is reviewed in the introduction.

Secondly, there are consistently positive correlations between test scores and homework. This result confirms previous studies reviewed by Cooper (1989). There are two most probable explanations for this association. Perhaps the most straightforward is that doing more homework is causal to obtaining higher test scores. This seems probable because it is reasonable to expect that the amount of homework done will have a positive effect on test scores. However, an alternative explanation is that those who obtain higher test scores, possibly because they have higher intelligence or aptitude, have more positive attitudes to school and as a consequence do more homework. This hypothesis also seems plausible as a contributory factor in the positive associations between homework and test scores.

Third, the consistently and significantly higher correlations between homework and test scores among females than among males suggests that homework is a more important contributor to the test scores of females. Fourth, the higher scores in maths and science obtained by males is consistent with a number of other studies reviewed in the introduction. Yet males do less homework. This indicates that other factors such as interests, aptitudes, expectations and so forth must have favourable effects on the test scores of males which outweigh the effect of their doing less homework.

Fifth, the multiple regression analysis presented in Table 3 suggests that gender and the amount of homework are both independent determinants of test scores. The most reasonable explanation is probably that test scores are determined partly by motivation and effort, operationalized by the amount of homework, and partly by gender differences in specific abilities, of which mathematics and science are stronger in boys and reading is stronger in girls.

The finding that girls do more homework than boys should probably be regarded as an expression of the greater socialization of girls which appears in a wide range of behaviours such as their lower rates of aggression, crime, anti-social personality and conduct disorders (see, for example, Rutter, Giller and Hagell 1998). In terms of evolutionary psychology, the most probable

explanation for this gender difference is that throughout a wide range of species males compete with other males to secure status. Males who succeed in this intra-male competition acquire greater access to females and provide a selective advantage. A certain level of aggressiveness is required for success in these intra-male competitive struggles and has led to the evolution of a higher level of aggressiveness and resistance to socialization pressures among males.

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