BOYS V GIRLS

MATHS PERFORMANCE IN AFRICA

There is widespread evidence of the existence of a female disadvantage in performance in mathematics tests in high and middle-income countries. The causes behind these differences remain the subject of much debate: are they biological or societal? **Andy Dickerson**, **Steve McIntosh**, and **Christine Valente** look to sub-Saharan Africa to explore whether the experience of pupils here can offer any insights into the maths gender gap.

In the literature focussing on developing countries, an increasingly important theme has been the study of female discrimination in access to education. Lack of data has largely precluded the study of gender differences in test scores and instead the focus has been on school enrolment and, to a lesser extent, grade completion.

However, it is also important to analyse gender differences in the acquisition of cognitive skills in schools, and especially so for mathematics. Indeed, skills learnt matter more for individual income and economic growth than mere attendance (Hanushek and Woessman 2008). Research also shows that *mathematic* cognitive skills are more predictive of income than literacy skills (Glewwe 1996 and Jolliffe 1998 for Ghana, Moll 1998 for South Africa), and, in developed countries where more research on the subject has been carried out, the gender gap in mathematics has been found to be a significant contributor to gender wage differentials (Paglin and Rufolo 1990).

Nature or nurture?

The debate surrounding the causes of the gender gap in mathematics has essentially opposed two types of arguments, one biological and one societal. The first potential explanation for a female disadvantage in maths tests is a biological one. The two most prominent genetic arguments are: gender-specific profiles in spatial and numerical abilities leading to a greater male aptitude for mathematics, and higher dispersion of male than female performance in quantitative and spatial ability, so that larger numbers of men have unusually high scores.

The second type of argument focuses on cultural or societal explanations for the gender gap. It could be that factors that influence mathematics tests scores vary systematically across the genders, with boys having better characteristics for producing high test scores.

In the context of sub-Saharan Africa, it could, for instance, be the case that parents send their sons to better schools than their daughters, for the same reason as the enrolment statistics show that they are more likely to send their sons to school in the first place. If the gender gap is due to girls having worse characteristics (e.g. they are enrolled in worse schools) than boys, then after accounting for differences in such characteristics, the gender gap should disappear.

The second possibility is that family, school and societal influences affect boys and girls differently. If this were the case, then girls would only perform worse than boys under unfavourable circumstances.

A closer look at the data shows that the overall gap hides a lot of variation between groups.

Overall, girls do worse than boys

In order to measure and analyse gender differences in maths performance, we use data from two pan-African surveys of educational quality, the Southern and Eastern African Consortium for Monitoring Educational Quality (SACMEQ), and the Program for the Analysis of Education Systems (PASEC) which, taken together, cover 19 western, southern and eastern African nations. In total, our sample covers more than 40,000 Grade 5 (PASEC) and Grade 6 (SACMEQ) pupils spread between more than 3,000 schools surveyed between 2000 and 2006. We merge these microdata with national-level information on gender equality and development from various sources, as well as with characteristics of the subnational region, which we calculate based on Demographic and Health Surveys microdata.

Overall, girls obtain scores that are below those of boys by 1.4 percentage points in SACMEQ and 0.6 percentage points in PASEC countries, when we do not control for differences in the characteristics of the boys and girls. After accounting for these differences, the gap is about 1.7 percentage points in SACMEQ countries and 2.1 percentage points in PASEC countries, i.e. 4.2 and 5.4 percent of the boys' mean in each sample, respectively.

The data allow us to investigate the gender gap between pupils in the same school, thus ruling out systematic differences in school quality between boys and girls, as well as to control for differences in individual access to schooling inputs within the classroom.

In fact, the gap *increases* when differences in household and school characteristics are controlled for because of the lower enrolment of girls relative to boys in sub-Saharan Africa. As a consequence of this gender difference in enrolment, the girls we observe in schools are more likely to have wealthier, better educated parents than their male classmates.

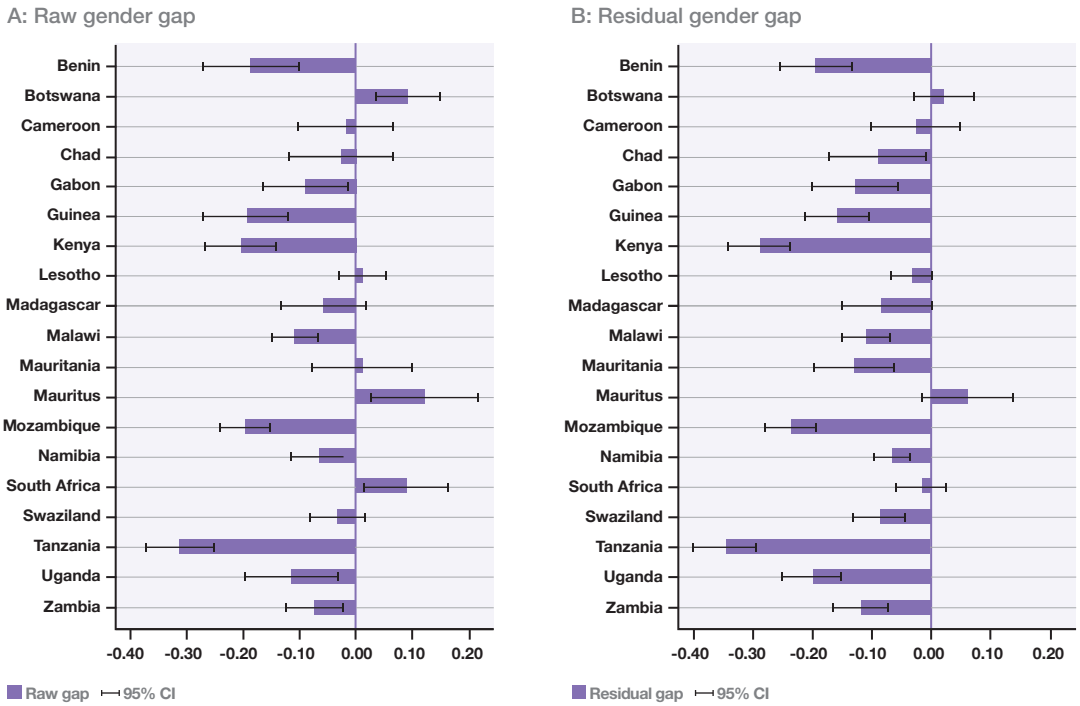
Significant variations between groups

At first glance, these findings may seem to suggest that girls indeed have some natural disadvantage in maths, since the gap is observed in Africa across both groups of countries, and is relatively stable both between the two groups of countries and compared to estimates for developed countries. However, a closer look at the data shows that the overall gap hides a lot of variation between groups.

Figure 1 plots the size of the gender gap in maths in each country, both in the raw data (left-hand side) and after accounting comprehensively for differences in family background, the schooling environment at home and at school (right-hand side). When comparing boys and girls with similar characteristics, girls obtain lower scores in 17 out of 19 countries, and the gender difference is statistically significant (i.e., meaningful) in 14 out of 19 countries.

When comparing boys and girls with similar characteristics, girls obtain lower scores in 17 out of 19 countries.

Figure 1
Raw and residual gender gap



Source: Authors' calculations using data from Southern and Eastern African Consortium for Monitoring Educational Quality (Botswana, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania (Mainland), Uganda, Zambia) and Program for the Analysis of Education Systems (Benin, Cameroon, Chad, Gabon, Guinea, Madagascar, Mauritania). The gap is expressed in standard deviations (s.d.) of the test score distribution for each group of countries. SACMEQ: 1 s.d. corresponds to 15.4 percentage points. PASEC: 1 s.d. corresponds to 18.5 percentage points.

A closer inspection of Figure 1 shows that the magnitude of the gap varies widely:

- In Mauritius, girls obtain on average 1 percentage point more than boys but in Tanzania, they lag behind boys by as much as 5.3 percentage points.
- Characteristics of parents, schools and region have an effect on the size of the gender gap. The gap is twice as large among children of uneducated mothers in SACMEQ countries, and only exists among children of illiterate parents in PASEC countries.
- Among children taught maths by a male teacher in SACMEQ countries the gap between boys and girls in twice as large, yet completely disappears when the teacher is female in PASEC countries.
- The gender gap tends to decrease with GDP per capita, although once differences in fertility rates are accounted for, differences in GDP become irrelevant

Taken together, our findings show that, although girls do not have characteristics that are less conducive to performing well in maths tests than boys, family, school and societal influences affect boys and girls differently in sub-Saharan Africa. They also suggest that there is no simple genetic explanation to the gender gap in maths. More research is needed in order

There is room for effective policy interventions.

to test the effect of specific interventions aimed at improving female performance in maths, but our results indicate that there is room for effective policy interventions since the observed gap is not due to some immutable female disadvantage.

This article is a summary of *'Do the Maths: An analysis of the gender gap in mathematics in Africa'*, by Andy Dickerson, Steve McIntosh and Christine Valente (2012) Mimeograph, University of Bristol and University of Sheffield.

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Further reading

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