Computational Algebraic and Analytic Geometry for Low-dimensional Varieties (organised by M. Seppälä, T. Shaska and E. Volcheck), these slides summarise work done in the preceding years that aimed to better understand the functional structure of the SCHUBERT package. It was also an attempt to speed it up for enumerative geometry computations on cuspidal and nodal cubics carried out with Josep M. Miret.

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The Gender Gap in Mathematics from the PISA Point of View

Elisabetta Strickland (University of Rome "Tor Vergata", Italy) on behalf of the WIM–EMS Committee

The Programme for International Student Assessment (PISA) is a triennial international survey (the last one started in 2012) that aims to evaluate education systems worldwide by testing skills and knowledge of 15-year-old students. To date, students representing more than 65 economies have participated in the assessment. The programme is an initiative of the Organisation for Economic Co-operation and Development (OECD), active since 1961, in which the member countries from across the world regularly turn to one another to identify problems, discuss and analyse them, and promote policies to solve them. PISA is unique because it develops tests which are not directly linked to the school curriculum. In their last survey, PISA asked students about their attitudes towards mathematics. The main facts that were outlined by the answers didn't actually state anything new but, as people are often sceptical about these problems, it's interesting to find out that even with a study quite different from the usual ones, the results are more or less the same. The main problems that have to be faced to fight the gender gap in mathematics are once again pointed out for public attention. These are:

1) In most countries and economies, girls underperform boys in mathematics. Amongst the highest achieving students, the gender gap in favour of boys is even wider.
2) The gender gap in mathematics performance mirrors the gender gap in students' drive, motivation and self belief.
3) Boys and girls tend to benefit equally when they persevere, are motivated to learn and have confidence in their abilities to learn mathematics. Consequently, the performance of both boys and girls suffer at the same rate when they lack motivation to learn and confidence in their own abilities.

Numbers in the survey state that many girls choose not to pursue careers in science, technology, engineering and mathematics because they do not have confidence in their ability to excel in mathematics, despite having the capacity and skills to do so.

Across the 65 countries involved in the survey, 57% of students intend to take additional mathematics courses after school finishes: 63% of boys but only 51% of girls.

Boys and girls are not equally likely to plan a career that involves a lot of mathematics, compared to careers that involve more science. On average, only 38% of girls but 53% of boys plan to pursue a career that involves a lot of mathematics rather than one that involves a lot of science. In addition, evidence from previous PISA cycles – when students were asked about the kind of career they expect to pursue as young adults – suggests that even those girls who envision pursuing scientific careers expect to work in fields that are different from those the boys expect to pursue.

Girls are over-represented among students who expect to work in the health and social fields, while boys are over-represented among 15-years-olds who expect to work as engineers or computer scientists.

Some facts about the survey are really quite interesting: for instance, the average girl in Shanghai-China scores 610 points in mathematics, well above the average performance of boys in every other country and school system that participated in PISA. Meanwhile, the average boy in Shanghai-China scores 557 points in reading, higher than the average performance of girls in every other participating country and school system, except for Hong Kong-China, Japan and Singapore.

Of course, gender differences in mathematics performance are much wider in some countries and economies than in others: the gender gap in mathematics is larger in Austria, Chile, Colombia, Costa Rica, Liechtenstein and

Luxembourg; no gender gap is observed in 23 countries and economies; and in Iceland, Jordan, Malaysia, Qatar and Thailand, girls outperform boys in mathematics.

Interestingly, in mathematics, the gender gap in favour of boys is largest among the best performing students. Among the poorest performing students, performance differences related to gender are small or non-existent.

Since it focused on mathematics performance, PISA 2012 collected detailed information about students' strengths and weaknesses in solving various types of mathematical problems.

For example, the gender gap in favour of boys is wider when looking at students' abilities to formulate concepts mathematically compared to when looking at students' abilities to employ or interpret mathematical concepts. Many students, particularly girls, feel anxious about mathematics and have low levels of confidence in their own abilities, even if they perform well in mathematics. What is particularly worrisome is that, even when girls and boys perform equally well, girls are more likely to feel anxious toward mathematics and have less confidence in their own mathematical skills and their ability to solve mathematics problems.

Gender gaps in drive, motivation and self belief are particularly troubling because these factors are essential if students are to achieve at the highest levels. And PISA results show that the relationship between drive, motivation and mathematics-related self belief on the one hand and mathematics performance on the other is particularly strong amongst the best performing students. Unless girls believe that they can achieve at the highest levels, they will not be able to do so.

Indeed, a substantial proportion of the difference in mathematics performance related to gender can be explained by the difference in boys' and girls' self belief and motivation to learn mathematics.

The gender gap in mathematics performance has remained stable in most countries since 2003, as has the gender gap in mathematics self belief. In the short term, changing these mindsets may require making mathematics more interesting to girls, identifying and eliminating gender stereotypes in textbooks, promoting female role models and using learning materials that appeal to girls. Over the long term, shrinking the gender gap in mathematics performance will require the concerted effort of parents, teachers and society as a whole to change the stereotyped notions of what boys and girls excel at, what they enjoy doing and what they believe they can achieve.

It's natural to agree with the PISA conclusion after the survey, which states that the gender gaps in mathematics require a concerted effort by parents and educators to challenge and eliminate gender stereotypes and bolster girls' belief in themselves.

Reference

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