

Project Maths Students Outperform Students Studying Older Mathematics Syllabus

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The latest report from the Educational Research Centre shows that 15-year-olds who had studied mathematics under the new Project Maths syllabus outperformed students who had studied under the older syllabus on both PISA 2012 and Junior Certificate mathematics. Students studying under Project Maths also showed stronger performance on PISA questions dealing with Space and Shape, an area in PISA on which Ireland has historically been weak.

Project Maths is an initiative to introduce a new mathematics curriculum into post-primary schools. The Revised curriculum has a stronger emphasis on developing students' understanding of mathematical concepts and applying mathematical knowledge to solve real-life problems than the previous mathematics curriculum. The Project Maths initiative began in 2008 in 23 schools throughout Ireland. All of these *Initial* schools were selected to participate in the OECD's Programme for International Student Assessment (PISA) in 2012, presenting an opportunity to compare the performance of students in *Initial* schools with that of students in *Non-initial* schools. The purpose of the comparison was to assess the impact, if any, of Project Maths on students' mathematics achievement. PISA assesses how students reason mathematically and use mathematics concepts in real-life contexts, and measures aspects of students' knowledge and skills similar to those that are emphasised in the new Project Maths curriculum.

The results reported here suggest a small but positive impact of Project Math: When controlling for factors such as school and student socio-economic status, gender, and attitudes towards mathematics, students in Initial schools scored significantly higher on PISA mathematics, by 10 score points, than those in Non-initial schools. Students in Initial schools also outperformed students in Non-initial schools on Junior Certificate mathematics, achieving one-third of a grade higher, though, unlike in PISA, students in Initial and Non-initial schools sat different examinations. Students in Initial schools performed better on the PISA Space and Shape content area, with female students in Initial schools doing particularly well.

According to Dr. Brían Merriman, one of the authors of the study, "PISA 2012 occurred early in the life of Project Maths and these kinds of initiatives often take several years to have an impact on performance. The gains noted in the current study are small but encouraging, and suggest that, over time, Project Maths can be expected to improve student performance in mathematics at all levels."

Teachers in Initial Project Maths schools reported engaging more often than teachers in Non-initial schools in activities likely to promote greater understanding of mathematics, including group and pair work, the integration of mathematics-specific software and other resources into mathematics lessons, and encouraging students to explain their reasoning and to explore different approaches to problem-solving. Teachers in all schools expressed concerns about the increased literacy demands of Project Maths questions. The report highlights the importance of Continuing Professional Development and support for teachers that is designed to address such concerns and support them in improving teaching and learning.

Surprisingly, attitudes towards mathematics were more negative among students in Initial schools, compared with students in Non-initial schools. According to Dr. Gerry Shiel, another author of the study, "Greater anxiety about mathematics and lower mathematics self-concept among students studying under Project Maths may reflect concerns about assessment, as students in Initial schools were among the first to take the revised Junior Certificate mathematics exam. Over time, we can expect to see some of these concerns recede as teachers and students become more comfortable with Project Maths, and this should result in more positive attitudes towards mathematics among all our students."

Notes:

PISA, the Programme for International Student Assessment, sponsored by the Paris-based Organisation for Economic Cooperation and Development (OECD), takes place every three years. In Ireland, over 5,000 students in 182 post-primary schools participated in PISA 2012 among 500,000 in 65 countries and economies. They completed paper-based tests of mathematics, reading, and science, as well as computer-based tests of mathematics, reading, and problem-solving. The students, their school principals, mathematics co-ordinators, and mathematics teachers also completed questionnaires that provided contextual information. Of the 182 participating schools in Ireland, the 23 Initial schools had been teaching the Project Maths curriculum since 2008. The Non-initial schools were in the process of implementing Project Maths and most PISA 2012 students had not studied mathematics under Project Maths.

The PISA sample comprised students in Second year (1.9%), Third year (60.1%), Transition Year (24.3%) and Fifth year (13.2%). Students in the Third and Transition year classes in Non-initial schools had not studied under Project Maths at the time of the study. Students who completed the Junior Cert Mathematics Exam in 2011 (Transition/Fifth years) or 2012 (Third Years) were included in the analysis of Junior Certificate mathematics examination results.

The mean score for students on PISA 2012 paper-based mathematics in Ireland was 501.5, and the standard deviation was 84.6. Hence, the 10-point gain reported here equates to a modest but positive difference of one-eighth of a standard deviation. Ireland had a mean score that was significantly higher than the OECD average of 494.0 (standard deviation of

91.9). Ireland's performance ranked 13th out of 34 OECD countries and 20th out of 65 participating countries/economies.

The results for overall PISA mathematics and Junior Certificate mathematics reported here are based on multi-level models of performance, where factors such as school and student socio-economic status, school sector (whether in secondary, vocational, or community/comprehensive), student gender, and student anxiety about mathematics, mathematical self-concept, intrinsic motivation, and grade level. For the analysis of Junior Certificate mathematics performance, grades achieved by students were projected onto a scale ranging from 1 to 12, such that a score of 12 represented Grade A at Higher level, and a score of 1 represented an F at Foundation level. The outcomes of Space and Shape are based on univariate analyses.

Test administration in Ireland for the next PISA cycle, PISA 2015, takes place in Spring 2015. Unlike previous PISA cycles, PISA 2015 will be administered entirely by computer in Ireland and in most of the 72 participating countries.

Further information:

The full report, *Project Maths and PISA 2012: performance in Initial Project Maths schools and in Non-initial schools on PISA 2012 Mathematics and Problem-solving and on Junior Certificate mathematics* by Brían Merriman, Gerry Shiel, Jude Cosgrove, and Rachel Perkins, is available for download at www.erc.ie.

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