

Learning from Countries that Excel in the PISA Research in Mathematics

Abstract based on a research by the Israel National Academy of Sciences

When looking at the top 15 countries with a high proportion of students excelling in mathematics, as reflected by the international PISA research, a highly diverse picture emerges. These countries are located on almost every continent, some are very small and others are highly populated. They are characterized by different ethnicities, religions and forms of government. This being the case, the question arises, what have they been doing in the area of education that leads to their apparent success?

A study by the Israel Academy of Sciences focused on five of these excelling countries: Singapore, the Netherlands, Estonia, Ontario/Canada, and Slovenia. Academic research and official publications were analyzed, and in-depth interviews were conducted with mathematics teachers and mathematics education researchers. The goal was to learn from their practice and insight, and to try to identify some common characteristics.

Main findings

1. In these countries, mathematics is considered the most important area of study in school. Significant resources are allocated to it, including the highest number of study hours per week. The public media covers development that relate to policy changes and student achievement, with greater emphasis on mathematics. Parents are highly involved in their children's learning of mathematics and in some cases; they are even given legal status by law.
2. These high performing education systems reviewed and reformed their mathematics curriculum, some as long ago as 20 years ago or more. The goal was to facilitate active and collaborative mathematics study in real-life contexts. Consequently, students in these countries learn how to use mathematics and cope with authentic problems, using mathematical modeling and reasoning and aided by algorithms and databases.
3. In all countries, mathematics is taught in ability groups, starting at different ages. Significant efforts are devoted to encouraging students to move up in level and individual support systems are run to help them advance. Various enrichment programs, including competitions and quizzes, are offered to students who are interested in learning more.
4. An examination is administered before entrance into high school. In most countries the test is individual and influences placement into a specific mathematics track. In others, nationwide tests are also administered in order to learn about the quality of practice. The results serve the schools and the policymakers to direct resources and support accordingly.
5. The teaching profession in these countries is highly regarded as a knowledge-based professional. The selection process for teaching training programs is rigorous and competitive, and the courses are of high quality. Career paths for teachers are well planned in alignment with professional performance, and the professional development is carried out continuously in practice-based learning communities.