



The Structure of Mathematics Education in Middle Schools around the World

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THE NATIONAL INSTITUTE FOR TESTING & EVALUATION



October 2018

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The aim of this survey is to examine the study of mathematics in countries with high PISA test achievements in mathematics, and which have a degree of cultural and systemic similarity to Israel, in order to try to learn from them. Nine countries were selected: Finland, Canada (Ontario), Switzerland (Fribourg Canton), UK, Singapore, Ireland, the Netherlands, New Zealand and Australia (Victoria).

In each country, we examined the structure of secondary school mathematics education, the curriculum, the tests, scope of studies, ways of arousing motivation for excellence, and teacher training.

Structure of studies

In all of these countries, students are divided by ability into groupings or study tracks in mathematics. In certain countries (Singapore and Finland) students are placed into home room class from which the level of mathematics study is derived. In other countries, students are divided into groups according to level only in the mathematics class (as is the case in Israel). There are also countries in which there is no rigid division into levels of study but rather, each student has their own schedule and learning plan and the student progresses along the levels of study (as in Victoria, Australia), and where she or he can choose the course of study (A-levels, UK).

There are countries where there is a structural separation between middle school and high school and others (such as, Canada) where students transition directly from primary school to secondary school. At times, middle school is part of primary school, and sometimes, part of secondary education. The number of years of compulsory education varies from one country to another and occasionally (as in the UK, for example) the final years of schooling are open to high achievers interested in, and capable of, continuing to higher education following secondary education.

Curriculum

In countries where students are placed into study tracks of different levels starting from age 12-13 (such as Switzerland, Singapore and the Netherlands), students' achievement captures a central place in the curriculum. In countries that advocate individual study adapted to each student's abilities and needs (such as Canada, Finland and New Zealand), the student is the focus of the curriculum.

In general, in countries characterized by excellence, mathematics curricula are not limited to acquiring knowledge and fluency in the mathematics topics studied, but they seek to instill thinking, research and critiquing skills, to encourage independent thinking, to create links between mathematics and life, and the ability to put mathematical knowledge and skills into practice in other areas. They even aim to impart and develop "soft" skills such as the ability to present and communicate conclusions, or the ability for teamwork.

Tests

National tests generally take place at the end of each stage of learning, at the end of primary, middle, and high school. National tests are usually used to assess the student’s level of knowledge and some are used for placement into a study track, a study level, or admission to higher education. There are tests intended to identify difficulties, to improve the curriculum, or for formative assessment, but these are not as common.

	Finland	Canada (Ontario)	Switzerland (Fribourg)	UK	Singapore	Ireland	Holland	New Zealand	Australia (Victoria)
Start of middle school		National test – end of 9th grade	Test – division into study tracks		PSLE – end of primary school: placement and tracks in high school		CITO – end of primary school: (mainly tests competencies)		
During secondary education	Tests – end of 9th grade: assess achievement and improve curriculum		High school entrance exam			End of middle school			VCE – certificate based on school and external assessment, to describe progress and what is needed to complete certain study areas
End of secondary education	Matriculation examination	Matriculation examination	Matriculation examination	Matriculation examination (GSCE) -end of 10th 11th grades, A-Level tests for students studying at that level		High school completion test	High school completion test	Graduated matriculation examination over final 3 years of studies	Ranking certificate (ATAR) used to set ranking for admission to and tracking in universities

Motivation for excellence

The countries surveyed have supplemental programs of different types whose aim is to promote excellence and increase motivation in the field of mathematics. These include in school excellence programs whose goal is to increase curiosity and interest in mathematics and to encourage the study of mathematics at a high level; extracurricular enrichment programs run in cooperation with external (academic, educational, and commercial) bodies designed to develop thinking skills and to stimulate curiosity (these include special events, competitions, academic courses for outstanding students, quiz programs, and more); a program whose objective is to create a vision of the future and to encourage entrance into technological professions, etc.

Teacher training

In all the countries surveyed, mathematics teachers require an academic degree, in most cases, in mathematics or in a scientific field. In some countries, high school teachers need a higher degree than middle school teachers. There are countries that require a teaching degree as well, while in others, teacher training is carried out by specialized bodies, outside academia. In countries suffering from a shortage of mathematics teachers, there are special programs for training and career change.