Cyprus

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Introduction

Overview of Education System

Education governance in Cyprus is centralized, while overall responsibility rests with the Ministry of Education, Sport and Youth (MoESY). The MoESY is responsible for the administration of education, the enforcement of laws, and the implementation of education policies, as well as the preparation of the education budget.[1] In addition, the MoESY sets out public school curricula and textbooks for all subjects. The Educational Service Commission, an independent five-member body, is responsible for appointments, secondments, transfers, promotions, and discipline (including dismissal) of public school teachers. Autonomy at the school level is very limited.[2]

Education is provided through preprimary, primary, and secondary education institutions. Compulsory education lasts 10 years and extends from the age of 4 years 8 months (preprimary education) to age 15 (lower secondary education). Public education is free for all students ages 4 years 8 months to 18 years.[3]

Preprimary education includes the education of children ages 3 to 6 in public, community, and private schools.[4] Preprimary education is compulsory for children ages 4 years 8 months to 6.[5]

Primary education (Grades 1 to 6) is mainly provided for children ages 6 to 12 in public schools. Secondary education (Grades 7 to 12) for students ages 12 to 18 in public schools includes two 3-year levels: the gymnasium (lower secondary education, Grades 7 to 9) and the lyceum (upper secondary education, Grades 10 to 12).[6] The gymnasium comprises general education, whereas the lyceum (which has adopted a different structure since academic year 2015–2016) allows a course selection system. Beyond the common core subjects, students can choose one group of subjects out of four (four teaching periods per week) at Grade 10, and one group out of six at Grades 11 and 12 (16 teaching periods per week).[7] As an alternative to the lyceum, students may attend secondary technical and vocational schools in two directions.[8]

Although the majority of students enroll in public school, some children attend private school; in 2020–2021, 11.2% percent of students at the primary level and 20.2% of students at the secondary level attended private school for their education.[9] Private schools fall into three categories: (1) schools “of the same type” follow public school curricula; (2) schools “of similar type” follow public school curricula by two thirds (that is, two thirds of the major subjects offered

in public schools are taught in these schools with respect to time and subject content); and (3) schools "of a different type" belong to neither of these two categories[10] and instead implement a curriculum and timetable that correspond to the education system of a different country.[11]

Use and Impact of TIMSS

TIMSS 2023 is the seventh TIMSS cycle for Cyprus, following participation in 1995, 1999, 2003, 2007, 2015, and 2019. Since 2015, the Centre of Educational Research and Evaluation (CERE) of the Pedagogical Institute (MoESY) has managed participation in TIMSS. The CERE disseminates the results of the study to stakeholders and the public through the presentation and publication of relevant documents (e.g., the TIMSS National Report).[12] The release of TIMSS results is followed by local media coverage that stimulates extensive public discussion on the performance of Cypriot students, especially in comparison to students of other countries.

The results of Cyprus in previous TIMSS cycles have led the MoESY to form committees to prepare recommendations about improving learning outcomes.[13]

The Mathematics Curriculum in Primary and Lower Secondary Grades

This section focuses on the national mathematics curriculum implemented in the vast majority of schools, i.e., all public schools and private schools "of the same type." The main focus of the curriculum is to help students acquire essential mathematical knowledge and competencies in ways that meet the needs of each individual as a constructive, concerned, and reflective citizen. Moreover, the curriculum focuses on the development of students' mathematical reasoning, conceptual understanding, problem-solving skills, procedural knowledge, and positive attitudes toward mathematics. An integrated approach from preprimary to secondary education is adopted, taking into consideration that the mathematics content is described for each grade according to two axes: (1) attainment targets and (2) adequacy targets, which include activity levels (prerequisite knowledge, new concepts, and corresponding examples) and examples of mathematical practices. The organization of the curriculum, based on these two axes, ensures coherence and connection among the different mathematical concepts within each grade and between the grades.[14]

Since academic year 2018–2019, mathematics instruction at the primary level has been allocated seven teaching periods per week (out of 35) for Grades 1 to 4, and six periods for Grades 5 and 6.[15] At the gymnasium, the respective teaching periods are five per week (out of 38) for Grade 7 and four for Grades 8 and 9.[16]

Private schools "of similar type" or "of a different type" approach mathematics in different ways in terms of the curricular content and the teaching periods allocated to the subject, often ranging from 3.5 to 8 teaching periods per week.[17]

Fourth-Grade Mathematics Curriculum

The educational material for Grades 1 to 6 is based on new trends in the teaching and learning of mathematics, which involve students' active engagement in the construction and acquisition of mathematical concepts, the development of epistemological approaches regarding the new mathematical concepts, and differentiated instruction. The didactical model that emerges from the new mathematics curriculum, and that reflects these new trends, refers to the phases of exploration, investigations, activities, and evaluation.[18]

Exhibit 1 outlines the mathematics curriculum for Grade 4 that was in effect during the 2022–2023 academic year.[19]

Exhibit 1: Fourth-Grade Mathematics Curriculum

Unit	Topics
Numbers and Operations	• read, write, represent, compare, and order whole numbers up to 1,000,000 • round whole numbers up to 100,000 • perform mental addition and subtraction with numbers up to 10,000 • estimate and calculate addition and subtraction with whole numbers up to 100,000 • develop and apply standard algorithms for addition and subtraction with whole numbers up to 1,000,000 • perform mental multiplication and division • develop and apply standard algorithms for multiplying multiple-digit whole numbers by one-digit whole numbers • develop and apply standard algorithms for dividing multiple-digit dividends by one-digit divisors • understand and use the concepts of divisor, dividend, remainder, factor, and multiple • understand the criteria of divisibility for 2, 5, and 10 • solve and pose routine problems involving addition and multiplication • solve nonroutine problems using multiple strategies (e.g., logical reasoning, working backward, trial and error, using materials, making a table, looking for patterns, making a drawing, simplifying the problem) • understand the concept of fractions as parts of a whole and as parts of a set of discrete objects • calculate parts of a whole number • understand fraction equivalence • compare and order fractions and decimal numbers with up to two decimal digits • use fractions to represent units

Exhibit 1: Fourth-Grade Mathematics Curriculum (Continued)

Unit	Topics
Numbers and Operations	• add and subtract like fractions • read, represent, and compare decimals with up to two decimal digits • convert between decimal numbers and fractions with a denominator of 10 or 100
Measurement	• use conventional units of measurement for length (mm, cm, m, km), mass (kg, g), capacity (l, ml), and volume (m^3, cm^3) • relate units of measurement for length (1 m = 100 cm = 1,000 mm), mass (1 kg = 1,000 g), and capacity (1 L = 1,000 ml) • measure the area and perimeter of rectangles and squares using appropriate formulas • measure the area of right triangles • use decimals to represent quantities of money • relate units of measurement for time (e.g., year, decade, century) • solve problems involving the relationship between hours and minutes
Geometry	• identify and construct right, acute, and obtuse angles in two-dimensional shapes • identify and name parallel and perpendicular lines • identify parallel and perpendicular sides in two-dimensional shapes • identify, name, and describe polygons using appropriate terms • identify and name parallelograms • classify shapes based on their sides (e.g., parallel or perpendicular) and angles (e.g., specified or unspecified magnitude) • identify and name three-dimensional shapes (e.g., cube, rectangular prism, prism, pyramid, sphere, cylinder, cone) using appropriate terms • identify faces, edges, and vertices • identify and match nets with specific three-dimensional shapes • identify and construct the line symmetry in two-dimensional shapes • identify, complete, and construct symmetrical shapes (with a horizontal or a vertical line of symmetry) • describe the position of an object • give a sequence of instructions related to position using the language of position and movement
Algebra	• identify, complete, and generate patterns • describe the rule of patterns • build numerical and figural patterns • model problems using mathematical expressions with a symbol for the unknown number • solve and pose routine problems involving additive and multiplicative structure with one or two operations

Exhibit 1: Fourth-Grade Mathematics Curriculum (Continued)

Unit	Topics
Algebra	• solve nonroutine problems • use the commutative and associative properties of addition and multiplication and the distributive property of multiplication to simplify calculations and verify results • use the distributive property of multiplication (along with addition and subtraction) to calculate products
Statistics and Probability	• interpret and construct bar charts, tables, and picture graphs using a legend • interpret pie charts • order events based on their possibility of occurrence using the concepts impossible, less possible, equally possible, possible, and certain

Eighth-Grade Mathematics Curriculum

The mathematics curriculum in secondary education ensures that students appreciate the value of mathematics and its usefulness; develop confidence, attitudes, knowledge, and skills that will help them to use mathematics in their daily life; solve problems in multiple ways; think and decide in a creative and logical way; use the necessary knowledge required in the modern information society; and acquire knowledge and skills to continue their studies in subjects in which the use of mathematics is essential.[20]

Exhibit 2 outlines the mathematics curriculum for Grade 8 that was in effect during the 2022–2023 academic year.[21]

Exhibit 2: Eighth-Grade Mathematics Curriculum

Unit	Topics
Real Numbers	• properties of exponents where the index is a natural number • rational numbers raised to integer exponents • square and cubic roots • properties of roots • the Pythagorean theorem
Algebraic Expressions	• monomials • operations with monomials • polynomials • addition of polynomials • multiplication of polynomials • division of polynomials

Exhibit 2: Eighth-Grade Mathematics Curriculum (Continued)

Unit	Topics
Geometry	• symmetry • parallelograms • orthogonal parallelograms • rhombuses • squares • trapezoids • circumference of a circle • area of a disk
Equations and Inequalities	• first-order equations in one variable with one parameter • solving formulas for a given variable • properties of inequalities • first-order inequalities • solving simultaneous inequalities, interval presentation
Functions	• relations and functions • linear functions, lines • special cases of linear functions • slope of a line
Proportional and Inversely Proportional Quantities	• proportional quantities • inversely proportional quantities
Statistics and Probability	• measures of central tendency (mean, median, and mode) • experimental probability—the basic counting principle

The Science Curriculum in Primary and Lower Secondary Grades

This section focuses on the national science curriculum implemented in most Cyprus schools, i.e., all public schools and private schools "of the same type."

Private schools "of similar type" or "of different type" approach science in different ways. Most of them teach science as an integrated course; some provide biology, chemistry, and physics as distinct subjects; and some provide instruction for geography as well. The content of these subjects varies across schools. Important variation is also noted regarding the number of teaching periods allocated for these subjects.[22]

Fourth-Grade Science Curriculum

In primary education, the structure and content of the curriculum are based on two axes: (1) acquiring knowledge and constructing concepts related to everyday experiences, enabling students to formulate interpretations of the phenomena they observe in their environment; and (2) developing skills, attitudes, and behaviors toward competencies that are useful both for

everyday life and lifelong learning.[23] The development, as well as the application of the learning content, is based on the principles of various theories and procedures, such as constructivism and inquiry-based learning.[24] As of the 2011–2012 academic year, science at the primary level is taught as Science and Technology in Grades 1 to 4 and as Science in Grades 5 and 6. Science in Grades 1 to 6 is allocated two teaching periods per week (out of 35).[25]

Exhibit 3 presents the science curriculum for Grade 4 that was in effect during the 2022–2023 academic year.[26]

Exhibit 3: Fourth-Grade Science and Technology Curriculum

Unit	Topics
Life Science	• plant transpiration • adaptation mechanisms of plants and animals that help them survive in their environment • Cyprus ecosystems and the importance of their conservation • sea, river, and lake pollution
Human Body	• musculoskeletal system
Electricity	• simple electric circuits • conductors and insulators • technologies for generating electricity, their strengths and weaknesses
Light	• rectilinear propagation of light • transparency of materials • shadow formation and factors that influence the size of shadows
Heat and Temperature	• water phase changes during heating or cooling • water cycle • phase changes of other materials
Matter	• mixtures and solutions • factors that influence dissolution time • separation of water solutions into their constituents • composition of air

Eighth-Grade Science Curriculum

In secondary education, the four science domains (physics, geography, chemistry, and biology) constitute distinct entities of the curriculum, each with a separate slot in the school timetable.[27] Earth science does not appear as a distinct curriculum subject but as part of the geography curriculum.[28] Physics and chemistry are introduced in Grades 8 and 9, with two teaching periods and one teaching period per week, respectively (out of 38).[29] Biology and geography are introduced in Grade 7 with two teaching periods and one teaching period per week, respectively. Teaching time for biology is one period in Grade 8 and two periods in Grade 9, while teaching time for geography is one period in Grade 8.[30]

Physics aims to help students develop an overview of key concepts; appreciate essential aspects of scientific inquiry; develop competence with the use of relevant technical equipment and apparatuses; draw on their accumulated experiences with science processes to inform their way of thinking more broadly; develop positive attitudes toward science; identify applications of science in daily life and appreciate the interactions between science, technology, and society; and realize how engagement with science could help people shift away from prejudices.[31]

Geography (earth science) is based on three study axes: geographic systems, the geographic characteristics of a place, and decisions based on evidence. The basic underlying principle is that geography today should educate teenagers to understand and "care" for the environment they live in (sustainable development) and to be interested in what is happening on our planet (global citizens). In addition, the lessons should provide geographical knowledge and skills that young people need in order to be able to make the right decisions in their lives (critical thinking), as well as foresee and realize the consequences of these decisions in the preservation and proper management of the environment and the well-being of the inhabitants of Earth. They should also be able to suggest ways and solutions toward the rational management of the environment.[32]

Chemistry draws on student-centered, inquiry-based approaches with a view to actively engage students in the learning process. Teaching aims to help students develop their own understanding of chemistry-related concepts and reasoning skills. The units not only focus on the domain but also seek to help students develop positive attitudes toward learning chemistry by drawing connections between concepts and everyday experiences.[33]

Biology aims to promote six components of science learning: conceptual understanding, epistemological competence, attitudes, reasoning skills, practical and scientific skills, as well as experiences. In addition, biology aims to address students' misconceptions and alternative ideas. The learning materials are organized in a way that promotes innovative pedagogical approaches, such as inquiry, problem-solving, cooperative learning, constructivism, and field work/experimentation. Different activities enable students' active involvement in the learning process, emergence of students' ideas, and reconstruction of students' ideas, as well as implementation and review of new ideas. Through collaborative learning, students are expected to develop communication and collaboration skills, as well as democratic citizenship.[34,35]

Exhibits 4, 5, 6, and 7 present the Grade 8 curricula for physics,[36] geography,[37] chemistry,[38] and biology,[39] respectively, that were in effect during the 2022–2023 academic year.

Exhibit 4: Eighth-Grade Physics Curriculum

Unit	Topics
Scientific Method and Measurements	• acquaintance with physics • concepts and measurements • fundamental measurements and scales (length, mass, time) • derivative measurements and scales (area, volume, density)
Motion in One Dimension	• reference point, frame of reference, position, time interval, distance traveled, displacement, scalar and vector quantities • speed and velocity • lab activity: measuring the speed of a car • uniform motion • motion diagrams: position, time and velocity, and time • how the slope of a position-time graph represents the velocity • identifying nonuniform motion • average acceleration
Forces	• the nature of force: a quantity measuring a push or a pull on an object; force is a vector quantity • measuring forces • representing a force • types of forces: contact and noncontact • Hooke's law
Forces	• estimating the resultant force: adding collinear forces • Newton's first law • Newton's second law • the force of gravity • Newton's third law
Pressure	• pressure and force: explaining everyday phenomena • definition of pressure • pressure in fluids • variation of pressure with depth in fluids • pressure measurements • buoyant force and Archimedes' principle • floating and sinking objects

Exhibit 5: Eighth-Grade Geography Curriculum

Unit	Topics
Europe	• location • list of physical features • list of climatic factors, vegetation belts • list of the causes of extreme weather conditions
Europe—Many Entities	• European Union (EU) member states, non-EU member states • physical, economic, social, and cultural features of the Mediterranean Region; people of the Mediterranean Region • environmental threats the Mediterranean Sea faces • location of the Danube River, Danubian countries • physical, economic, social, and cultural features of Danubian countries • environmental threats to Danubian countries • implementation of "European Rights" in the Mediterranean Region
Sustainable Development	• reduce, reuse, recycle • sustainable management of waste
Economic Geography	• economic sectors, employment
Globalization	• related terms • disadvantages

Exhibit 6: Eighth-Grade Chemistry Curriculum

Unit	Topics
Introduction	• contribution of chemistry to the evolution of civilization • familiarity with laboratory environment
Matter and the Structure of Matter	• the importance of water in our lives • mixtures • methods of separation of mixtures • solution: solvent and solute • the chemical composition of water, electrolysis of water • chemical elements and compounds • atoms and molecules • chemical formulas • atomic structure, atomic number, mass number

Exhibit 7: Eighth-Grade Biology Curriculum

Unit	Topics
Discovering Our Nutrition	• nutrition and organisms • nutrition habits and health • experiments: detecting nutrients in foods
Exploring Our Digestive System	• structure and function of the digestive system • structure, function, diseases of the digestive system • mechanical digestion of foods from cell to cellular organelles and macromolecules • How do food macromolecules break down? • chemical digestion, digestive enzymes from macromolecules to micromolecules • absorption of nutrients • nutrient energy
Studying Our Circulatory System	• circulatory system structure • structure and function of the heart • structure and function of blood vessels • the course of blood in the human body • blood and its components

Teacher Professional Development Requirements and Programs

The MoESY is responsible for organizing in-service training for teachers, mainly through the Cyprus Pedagogical Institute.[40] The institute offers compulsory and optional programs for teachers of all levels. These programs include courses, school-based seminars, conferences, and workshops that may address any subject thematically, including mathematics and science.[41] Another means of supporting teachers' professional development includes the implementation of the professional learning strategy.[42] All schools are expected to prepare a professional development action plan focusing on a specific issue, set as a priority, according to teachers' and students' needs. The enactment of this plan includes school-based training as well as school-based activities.[43] This strategy is not restricted to science or mathematics teaching.

In addition, primary school teachers who teach science or mathematics are supported by the respective inspectorate of the MoESY through training events at the school level, as well as regional training events or seminars.[44,45] Similarly, secondary school teachers of mathematics and the four science subjects are supported through compulsory or optional training/empowerment seminars.[46,47,48,49,50]

Private primary and secondary schools set their own selection criteria for recruiting teaching staff, but they often follow the methods of appointment of the public schools and recruit teaching personnel from the "waiting list" of the Educational Service Commission.[51]

Monitoring Student Progress in Mathematics and Science

In primary education, assessment is considered an integral part of teaching and aims to improve student progress, teacher effectiveness, and the curriculum itself.[52] Teachers are required to adopt a systematic approach to student assessment, employing different assessment types and techniques. Students are assessed based on the extent of their class participation; their results on oral and written tests prepared by their classroom teachers; and their results on work done in the classroom and at home, including project work. Three types of assessment are administered at the primary education level in Cyprus: (1) initial, or diagnostic; (2) formative, or continuous; and (3) final, or summative. Students do not receive grades or report cards but are awarded a school leaving certificate at the end of Grade 6.[53]

In academic year 2019–2020, a new assessment system was introduced in preprimary and primary public schools regarding formative assessment for mathematics and language. More specifically, a School Progress Report (SPR) is completed by the teacher for every student twice a year, at the end of the first semester (mid-January) and toward the end of the second semester (beginning of June). In this report, the teacher provides descriptive comments about the student's skills, attitude/behavior, and learning outcomes. The report also conveys a symbolic representation of the student's performance using a four-star rating system (*, **, ***, ****). In addition, the teacher arranges individual meetings with the parents of each student to discuss the progress report.[54]

Similarly, as of academic year 2019–2020, a new assessment system has been introduced in upper secondary education, encouraging the use of both formative and summative assessment to evaluate students' learning. This was initially enacted only in Grade 10 and was gradually extended to Grades 11 (in academic year 2020–2021) and 12 (in academic year 2021–2022). In academic year 2022–2023, the new assessment system was also implemented in lower secondary education. This system divides the school year into two semesters, each accounting for 50% of the final grade for the academic year. At the end of each semester, students take a written exam in a specific number of subjects (four to five). In lower secondary school, students take exams in Greek language, mathematics, history, physics, chemistry, and biology. In upper secondary school, students are examined in five subjects (Greek language and four other subjects depending on the group of subjects and direction they have selected). In both cases, the grade of the written assessment (semester exam) accounts for 40% of the subject's grade for each semester, whereas the remaining 60% is derived from other forms of assessment, such as class or lab participation, daily informal evaluation of students' participation, short written tests, long written tests, home assignments, and projects. Students' semester grades are reported according to a numerical scoring scale ranging from 1 to 20.[55]

The Pancyprian Examinations administered at the end of secondary education (Grade 12) are prepared centrally and implemented by the Examination Department of the MoESY.[56] The Pancyprian Examinations serve as entrance examinations for the public universities in Cyprus and Greece.[57]

Special Initiatives in Mathematics and Science Education

An important reform introduced in academic year 2014–2015 includes the revision and restructuring of the national curriculum for all subjects and grades on the basis of attainment and adequacy targets.[58] Attainment targets refer to the learning outcomes expected to be achieved by the end of each grade, whereas adequacy targets describe what needs to be taught for the outcomes to be achieved.[59] As a result, the respective teaching/learning materials were revised; in many cases, these materials are still undergoing iterative refinements to better address the relevant attainment/adequacy targets and accommodate feedback from teachers.

During academic year 2015–2016, a revised school timetable was implemented in public primary[60] and secondary schools,[61] involving minor differentiations in the distribution of teaching periods per subject. Specifically, at the primary education level, the number of teaching periods for mathematics increased by two for Grades 1 to 4 and by one for Grades 5 and 6.[62] At the lower secondary education level, the number of teaching periods for mathematics was increased by one for Grades 7 and 8. Changes were not made to the overall teaching time for science except from a redistribution of teaching periods for Grade 8 biology and geography: One teaching period was added for biology, while the number of teaching periods for geography was reduced by one.[63]

The application of the new curriculum and timetable aimed to strengthen the validity of the public school leaving certificate and ensure a more reliable system of access to public higher education institutions in both Cyprus and Greece.[64]

To promote the modernization and enrichment of school programs, the MoESY proceeded with the pilot implementation of the STE(A)M program (Science-Technology-Engineering-(Arts)-Mathematics) for both primary (in academic year 2019–2020) and secondary (in academic year 2021–2022) education. During academic year 2022–2023, the program was offered in nine schools for Grade 6 students, aiming to promote both the necessary key skills for the citizen and professional of the 21st century, as well as scientific literacy. In secondary education (Grades 7 to 9), the program was offered in academic year 2022–2023 as an option in two different all-day schools.[65]

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