

Portugal

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Introduction

Overview of Education System

The Portuguese education system is organized in three sequential education levels: preprimary education (ages 3 to 5), compulsory education (ages 6 to 17), and higher education (from age 18). In Portugal, education is compulsory for 12 years of schooling, or up to 18 years old (this extension was introduced for every student enrolled in the seventh grade or below as of 2009–2010).¹

Education policy is defined centrally by the Ministry of Education, which is responsible for the definition and enforcement of the core curricula and learning goals for each level of education and subject. The Ministry of Education also defines teaching method guidelines, which are adapted by teachers in each school in close relation with the school education project.

The Portuguese education network is composed of state funded (public schools) as well as private for-profit and nonprofit schools. The public network is organized in school clusters which are composed of schools that offer all education levels from pre-school education to secondary education under the leadership of a school principal. School clusters aim to facilitate transitions across education levels, as well as overcoming geographical isolation and social exclusion.

Preprimary education is not compulsory. However, it is universal for children ages 4 and 5 years old.² The main objectives of preschool education are the promotion of children's personal and social development and well-being, expression, communication, curiosity, and critical thinking abilities and involvement of families in their children's education.

Compulsory education starts at age 6 and is divided into basic education (nine years of school) and secondary education (three years of school). Basic education aims to ensure a common general education for all children, providing the fundamental knowledge and skills required for pursuing (upper) secondary education. It is divided into three sequential cycles: first cycle (Grades 1 to 4); second cycle (Grades 5 to 6); and third cycle (Grades 7 to 9). The first and second cycles correspond to primary education (ISCED 1), and the third cycle corresponds to the lower secondary education (ISCED 2).

In the first cycle of basic education, teaching is the responsibility of a generalist teacher who may be assisted by other teachers in specialized areas, namely: music, foreign language and physical education. The core curriculum focuses on Portuguese, mathematics and sciences.

The second and third cycles of basic education are organized into multidisciplinary areas of study taught by specialist teachers. The compulsory learning of a foreign language begins in the 3rd grade of the first cycle, with English as a mandatory foreign language for all students until the end of basic education in order to give students command of the language in a structured and sequential way. In the third cycle, a second foreign language is introduced and is compulsory.

Basic education can also be concluded and certified through different paths adapted to the profile and specific characteristics of the students, such as:

- education and training courses
- alternative curricular pathways
- integrated education and training program

Secondary education (Grades 10 to 12; ISCED 3) is organized into different education or training paths, providing access to higher education or entering active life. The scientific-humanistic path prepares students to enter higher education in the sciences, technology, and humanities. Specialized arts courses prepare students to enter active life or to follow higher education studies in music and performative arts, audiovisual arts, and dance. Vocational and professional paths prepare students to enter active life, but also allow the pursuit of higher education studies.³

Use and Impact of TIMSS

In 2019, Portugal participated in TIMSS at the fourth grade for the fourth time, having participated previously in TIMSS 1995, 2011, and 2015. In 2019, Portugal participated for the second time at the eighth grade, having previously participated in TIMSS 1995. There is no explicit mention of the TIMSS results or the TIMSS frameworks in the fourth grade and eighth grade national curricula development or other official policies aimed at basic education goals and orientations. However, the new upper secondary mathematics curriculum, introduced in the school year 2015–2016, mentions TIMSS Advanced (TIMSS assessment of students in the final year of secondary school who are enrolled in special advanced mathematics and physics programs; Portugal participated in TIMSS Advanced 2015 in mathematics) and reducing the gap between the national mathematics curriculum and the TIMSS Advanced framework.⁴

The Mathematics Curriculum in Primary and Lower Secondary Grades

The curriculum for mathematics includes general educational targets, planning instruction and teaching methods, mathematics subject matter and competencies and, also, general assessment guidelines for all of basic education (Grades 1 to 9). By the end of basic education, the curriculum should contribute to the acquisition of knowledge of facts and procedures; to the construction

and development of mathematical reasoning, communicating (oral and written) mathematics, and problem solving in different contexts, and a holistic and coherent view of mathematics.⁵

The general goals of the mathematics curriculum and its development during the three cycles of education are to:

- Promote the knowledge of basic mathematics facts and procedures
- Develop mathematical comprehension and reasoning
- Read and interpret different mathematical representations
- Develop, organize, and communicate mathematical ideas and reasoning
- Solve problems using mathematical knowledge and critically discuss the solutions reached
- Establish connections between different mathematical concepts and relationships, as well as relationships with nonmathematical contexts
- Develop autonomous mathematical work strategies
- Appreciate mathematics and its importance to other school subjects and daily life

The curriculum emphasizes three major skills required of all mathematical learning: mathematical reasoning, resolution of mathematical problems, and communication of mathematical results and conclusions.

Exhibit 1: Mathematics topics and content⁶

Cycles of education	Topic	Content
1 st cycle (Grade 1 to 4)	Numbers and Operations	<ul style="list-style-type: none"> ▪ Natural numbers, decimal numbering system, arithmetic operations (addition, subtraction, multiplication, and division), number sequences, identify and represent fractions, arithmetic operations with fractions and decimal numbers ▪ Decimal representation of non-negative rational numbers
	Geometry and Measurement	<ul style="list-style-type: none"> ▪ Location and orientation in space, geometric figures, angles, geometric properties, measure, distance and length, areas, volume and capacity, mass, time, money, problem solving
	Organization of Data and Data Processing	<ul style="list-style-type: none"> ▪ Representation of sets, data representation, data processing
2 nd cycle (Grade 5 to 6)	Numbers and Operations	<ul style="list-style-type: none"> ▪ Natural numbers, rational numbers (positive and negative rational numbers, addition and subtraction)
	Geometry	<ul style="list-style-type: none"> ▪ Geometric properties (angles, parallelism and perpendicularity), triangles and quadrilaterals, measure (area, angle width, volume), plane isometries, flat geometric figures, geometric solids and properties, problem solving
	Algebra	<ul style="list-style-type: none"> ▪ Algebraic expressions and properties of operations, natural exponent powers, sequences and regularities, direct proportionality
	Organization of Data and Data Processing	<ul style="list-style-type: none"> ▪ Cartesian charts, representation and data processing

Cycles of education	Topic	Content
3 rd cycle (Grade 7 to 9)	Numbers and Operations	<ul style="list-style-type: none"> Rational numbers, periodic finite and infinite tithes, non-periodic infinite tithes and real numbers, order relationship in \mathbf{R} (order relationship properties, intervals, approximate values of results of operations)
	Geometry and Measurement	<ul style="list-style-type: none"> Greek alphabet, geometric figures (polygonal lines and polygons, quadrilaterals), parallelism, congruence and similarity, measurement (changes in unit length and incommensurability, quadrilateral areas, perimeters and areas of similar figures, distances to a point plane, parallel lines and parallel planes, volumes and areas of solid surfaces), Pythagorean theorem, vectors, translations and isometries, axiomatization of mathematical theories (vocabulary of axiomatic method, axiomatization of geometry), parallelism and perpendicularity of lines and planes (Euclidean geometry and the axiom of parallels, parallelism of lines and planes in Euclidean space, perpendicularity of lines and planes in Euclidean space, problems), trigonometry, geometric places involving notable points of triangles, properties of angles, strings and arcs defined in a circle
	Functions, Sequences and Successions	<ul style="list-style-type: none"> Functions (function definition, operations with numeric functions, sequences and successions), graphs of related functions, algebraic functions
	Algebra	<ul style="list-style-type: none"> Algebraic expressions, square and cube roots, algebraic equations, full exponent powers, monomials and polynomials, incomplete 2nd degree equations, literal equations, systems of two 1st degree equations with two unknowns, inequalities, 2nd degree equations, inverse proportionality
	Organization of Data and Data Processing	<ul style="list-style-type: none"> Location measures, diagrams of extremes and quartiles, histograms, probability

The Science Curriculum in Primary and Lower Secondary Grades

The science curriculum in the first cycle of basic education (Grades 1 to 4) in Portugal is a core subject of a study domain designated Environment Studies.⁷ This study domain aims to promote students' understanding of the natural and social environment in which they live. In the first cycle, this study domain evokes knowledge from several scientific areas, namely geography, history, biology, physics, and chemistry.

The curriculum is developed around six thematic blocks:

- Discovering myself
- Discovering others and institutions
- Discovering the natural environment
- Discovering interrelations between places
- Discovering materials and objects
- Discovering relations between nature and society

In the second cycle of basic education (Grades 5 to 6), science is offered as an independent subject named Natural Sciences.⁸ The curriculum for this subject focuses on themes that are fundamental for students' comprehension of the functions of the Sun-Earth-life system. It addresses the domains of:

- Diversity of living beings and their interactions with the environment
- Diversity of living beings (animals and plants)
- Water, air, rocks and soil
- Vital processes common to living beings
- Aggressions of the environment and integrity of the organism

In the third cycle of basic education (Grades 7 to 9), science is taught as Natural Sciences⁹ plus Physics and Chemistry Sciences.¹⁰

The curriculum of Natural Sciences in this cycle of education is developed around major domains as Earth in Space, Earth in Transformation, Earth Sustainability and Living Better on Earth. During this cycle, students are introduced to external and internal Earth dynamics, consequences of internal Earth dynamics, Earth’s geological history, and the sustainability of life on Earth, Earth system, from cells to ecosystems, sustainable management of Earth’s resources, and better living on the planet.

The curriculum of physics and chemistry sciences is developed around the following major domains: Space, Materials, Energy, Chemical Reactions, Sound, Light, Movements and Forces, Electricity, and Materials' Classification.

Exhibit 2: Physics and Chemistry Sciences domains and sub-domains¹¹

Grade	Domain	Sub-domain
Grade 7	Space	▪ Universe, solar system, distances in the universe, Earth, Moon and gravitational forces
	Materials	▪ Constitution of the material world, substances and mixtures, physical and chemical transformations, physical and chemical properties of materials, separation of substances from a mixture
	Energy	▪ Energy sources and energy transfers
Grade 8	Chemical reactions	▪ Explanation and representation of chemical reactions, types of chemical reactions, speed of chemical reactions
	Sound	▪ Sound production and propagation, sound and waves, sound attributes and their detection by humans, acoustic phenomena
	Light	▪ Light waves and their propagation, optical phenomena
Grade 9	Movements and forces	▪ Earth movements, forces and movements, forces, movements and energy, forces and fluids
	Electricity	▪ Electric current and electrical circuits, effects of electrical current and electrical energy
	Materials' classification	▪ Atomic structure, material properties and periodic table, chemical bond

Professional Development Requirements and Programs

The professional development of teachers in Portugal is understood as a structural element in improving the quality, effectiveness and efficiency of the education system. The Ministry of Education promotes several programs for teachers' professional development in partnership with different higher education institutes and universities.

In parallel, the Ministry of Education, through the various agencies, promotes several training courses for teachers that aim to contribute, among other aspects, to improving the quality of teaching and students' school results and to the professional development of teachers and other education agents, in terms of their continuous improvement throughout life.

In-service training programs are part of a broader strategy of developing professional practice among teachers in order to equip them to meet the challenges of wider structural and organizational reforms in the education system.

Monitoring Student Progress in Mathematics and Science

Assessment is an integral part of educational practice, enabling the systematic collection of information essential for making appropriate decisions to improve the quality of student learning. According to Decree-Law No. 55/2018, student assessment includes formative and summative assessment.

Schools have pedagogical autonomy to define the assessment and monitoring criteria for each grade and study cycle in accordance with the orientation and goals of the national curricula. Teachers are responsible for students' assessment as well as for the awarding of marks. Students are internally assessed at the end of each term and each school year.

At a national level, the students' learning is monitored through low-stakes testing (standardized tests) provided by the National Education Assessment Institute (IAVE) in the second, fifth, and eighth grades in Portuguese, mathematics, sciences, English, history, geography, artistic education, and physical education.¹² As a result, detailed information about student performance in each domain of each subject is provided to schools.

National exams take place at Grade 9 (end of basic education), for Portuguese and mathematics, and at Grades 11 and 12 (end of compulsory education) for different subjects, including mathematics and science, depending on the group of subjects the student attends to. Results on national exams affect students' assessment and certification.

Suggested Readings

Eurydice. (2019). *National education systems: Portugal*. Retrieved from https://eacea.ec.europa.eu/national-policies/eurydice/content/portugal_en

Decreto-lei No. 55/2018 - *Curriculo nacional: Autonomia e Flexibilidade Curricular* [Decree-law No. 55/2018 National Curriculum -- Curricular autonomy and flexibility]. Retrieved from https://www.dge.mec.pt/sites/default/files/Curriculo/AFC/dl_55_2018_afc.pdf

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