

North Macedonia

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Introduction

Overview of Education System

Primary and secondary education in the Republic of North Macedonia is compulsory for all students. It is free and equally accessible to everyone. The Constitution (*Article 45 from 17.11.1991*) allows citizens to establish private education institutions at all levels except elementary. The Ministry of Education and Science is responsible for national education policy, including finance decisions, administration of state institutions, and establishing and monitoring education laws and regulations. Within the Ministry of Education and Science, several entities carry out the duties of the Ministry. One of them is the Bureau for Development of Education (BDE), an organization in charge of the curricula and the scheme of work development for primary schools as well as general subjects in secondary schools. The BDE also provides professional support for school improvement, professional development of school staff, and accreditation of teacher training providers. The Vocational Education and Training Center is responsible for developing the curriculum for vocational schools. The National Examination Centre is responsible for the external assessment of student achievement in elementary and secondary education, as well as training and certification exams for school directors and a credentialing exam for primary and secondary school teachers. The State Educational Inspectorate supervises legal and regulatory matters at all levels of education and monitors and evaluates the quality of schools. The Pedagogical Service inspects and approves the curricula, textbooks, and projects implemented in elementary and secondary education.

As a country in transition, the Republic of North Macedonia has been working toward decentralizing its education system and improving its quality, equality of opportunities, and efficiency. The purpose of decentralization is to transfer responsibility for teacher employment, salary decisions, and school maintenance to municipalities.

The education system in North Macedonia comprises preschool, primary, secondary, and higher education. Primary and secondary education are compulsory. Preschool education is optional and intended for children from 7 months to 5 years old. Children start school roughly at the age of 5 1/2. Primary education last nine years and is for students ages 6 to 15. Elementary education includes general education for Grades 1 to 5 and subject teaching for Grades 6 to 9.

Secondary education includes general academic schools; two, three, and four year vocational schools; and four year art schools (in art, music, or ballet). Students who choose four year

secondary education usually take the state Matura exams and continue their education at a university.

The official language in the Republic of North Macedonia is Macedonian. However, all national groups in Macedonia are entitled to primary and secondary education in their mother tongue. In primary schools, instructions are provided in Macedonian, Albanian, Turkish and Serbian, while in secondary schools, they are in Macedonian, Albanian, and Turkish. Ethnic Albanian students also have the right to education in Albanian in some departments at the university level.

Use and Impact of TIMSS

Participation in TIMSS had the following effects on education in North Macedonia:

- Awareness of Macedonian students' low results in mathematics, science, and language literacy
- Awareness of need for external evaluation of student achievement
- Start of compulsory education at age 6 and language curriculum for the first grade
- Introduction of a new science subject, natural sciences, which is compulsory for Grades 1 to 6
- Implementation of the Cambridge Curriculum for mathematics, chemistry, physics, biology, and natural sciences in primary education
- More emphasis in geography on physical geography versus economics
- Introduction of a project based learning approach
- Development of assessment standards and grading criteria

The Mathematics Curriculum in Primary and Lower Secondary Grades

The mathematics curriculum for Grades 1 to 9 was formed from 2014 to 2016. The Republic of North Macedonia is using the Cambridge International Assessment Curriculum adapted for Macedonian learners by the Bureau for the Development of Education. This curricular framework provides a comprehensive set of progressive learning objectives for mathematics for Grades 1 to 9. The objectives detail what the students should know or be able to do in each grade. They provide a structure for teaching and learning as well as a reference against which students' ability and understanding can be checked.

In primary schools, mathematics is taught 5 hours per week, or 180 hours per year, for Grades 1 to 6.¹ For Grades 7 to 9, it is taught for 4 hours per week, or 144 hours per year. Mathematics instruction makes up 13 to 21 percent of total instructional time, depending on grade.

The curriculum for Grades 1 to 5 covers five content areas: Numbers, Geometry, Measurement, Handling Data, and Problem Solving. The curriculum for Grades 7 to 9 covers six content areas: Numbers, Algebra, Geometry, Measurement, Handling Data, and Problem Solving. The first four content areas are all underpinned by Problem Solving, which describes using techniques and skills and the application of understanding and strategies in solving problems. Mental strategies are also

a key part of the Numbers content area. The curriculum focuses on principles, patterns, systems, functions, and relationships, so that learners can apply their mathematical knowledge and develop a holistic understanding of the subject. The Cambridge Primary Mathematics Curriculum Framework provides a solid foundation for later stages of education.

The Cambridge Curriculum is founded on the values of the University of Cambridge and best practices in schools. It is dedicated to developing learners who are confident, responsible, innovative, and engaged. Each curriculum framework is designed to engage students in an active and creative learning journey.

By the end of Grade 4, students are expected to have acquired sufficient knowledge in the following content areas:²

- Numbers—Students are expected to read and write numbers up to 10,000; count in ones, tens, hundreds, and thousands; understand place value in a three or four digit number and partition numbers into thousands, hundreds, tens, and ones; understand decimal notation for tenths and hundredths in context; find multiples of 10, 100, 1,000 and more/less than numbers of up to four digits; multiply and divide three digit numbers by 10 (whole number answers) and understand the effect; multiply using 2, 3, 4, 5, 6, 9, and 10 times tables and derive division facts; add and subtract near multiples of 10 or 100 to or from three digit numbers; add or subtract any pair of two digit numbers; find the difference between near multiples of 100; subtract a small number crossing 100.
- Geometry—Students are expected to identify, describe, visualize, draw, and make a wider range of two dimensional and three dimensional shapes; classify polygons (including a range of quadrilaterals) using criteria such as the number of right angles, whether they are regular, and their symmetrical properties; identify and sketch lines of symmetry in two dimensional shapes and patterns; visualize three dimensional objects from two dimensional nets and drawings and make nets of common solids; describe and identify the position of a square on a grid of squares where rows and columns are numbered and/or lettered; know that angles are measured in degrees and that one whole turn is 360 degrees, or four right angles; compare and order angles of less than 180 degrees.
- Handling Data—Students are expected to answer a question by identifying what data to collect; organize, present, and interpret data in tables, diagrams, tally charts, frequency tables, pictograms (symbol representing 2, 5, 10, or 20 units), and bar charts (intervals labeled in twos, fives, tens, or twenties); compare the impact of representations where scales have different intervals; use diagrams to sort data and objects using two or three criteria
- Problem Solving—Students are expected to choose appropriate mental or written strategies to carry out calculations involving addition or subtraction; understand everyday systems of measurement in length, weight, capacity, and time and use them to solve simple problems; check the results of adding numbers by adding them in a different order or by subtracting one number from the total

By the end of (*do kraj na*) Grade 8, students are expected to have acquired sufficient knowledge in the following areas:

- Numbers—Students can add, subtract, multiply, and divide integers; identify and use multiples, factors, common factors, highest common factors, lowest common multiples, and prime numbers; write a number in terms of its prime factors; calculate squares of positive and negative numbers; determine place value, ordering, and rounding; work with fractions, decimals, percentages, ratio, and proportion; find equivalent fractions, decimals, and percentages by converting between them; add and subtract fractions and mixed numbers; calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction; calculate and solve problems involving percentages and percentage increases or decreases; express one given number as a fraction or percentage of another
- Algebra—Students know that algebraic operations, including brackets, follow the same order as arithmetic operations; use index notation for positive integer powers; construct linear expressions; simplify or transform linear expressions with integer coefficients; collect like terms; multiply a single term over a bracket; derive and use simple formulas; substitute positive and negative integers into formulas, linear expressions, and expressions involving small powers; construct and solve linear equations with integer coefficients (unknown on either or both sides, without or with brackets); generate terms of a linear sequence using term-to-term rules and n th term rules to find any term in the sequence; find term-to-term and n th-term rules of sequences including visual representations; use a linear expression to describe the n th term of a simple arithmetic sequence, justifying its form by referring to the activity or practical context from which it was generated; express simple functions algebraically and represent them in mappings
- Geometry—Students are expected to know that the corresponding sides and angles of congruent two dimensional shapes are equal; classify quadrilaterals according to their properties, including diagonal properties; identify alternate angles and corresponding angles; solve geometrical problems using properties of angles, of parallel and intersecting lines, and of triangles and quadrilaterals, explaining reasoning with diagrams and text; draw nets of three dimensional shapes; identify the symmetries of two dimensional shapes; find the midpoint of the line segment AB ; transform two dimensional shapes by rotation, reflection, and translation, and simple combinations of these transformations; interpret and make simple scale drawings
- Measurement—Students are expected to be able to choose suitable units of measurement to estimate, measure, calculate, and solve problems in a range of contexts, including units of mass, length, area, volume, or capacity; draw and interpret graphs in real life contexts involving more than one component; know the definition of a circle and the names of its parts; know and use formulas for the circumference and area of a circle; derive and use formulas for the area of a triangle, parallelogram, and trapezium; calculate areas of compound two dimensional shapes and surface areas and volumes of cuboids

- **Handling Data**—Students are expected to identify and collect data to answer a question; select the method of collection, sample size, and degree of accuracy needed for measurements; calculate statistics for sets of discrete and continuous data; decide when to use the range, mean, median, and mode and, for grouped data, the modal class; draw and interpret data
- **Problem Solving**—Students are expected to calculate accurately, choosing operations and mental or written methods appropriate to the numbers and context; use the order of operations, including brackets, with more complex calculations; understand everyday measurement systems, using them to estimate, measure, and calculate; recognize, compare, and use properties of shapes in two and three dimensions; draw accurate mathematical diagrams, charts, and graphs; estimate, approximate, and check work; solve word problems involving calculations with whole numbers, fractions, percentages, decimals, money, or measures, including multistep problems

The Science Curriculum in Primary and Lower Secondary Grades

The science curriculum has not been integrated into primary education but is presented through a separate program of natural sciences, with 2 hours of instruction per week, or 72 hours per year, in Grades 1 to 6 of primary school (about 10 percent of the total instructional time). Exhibit 1 lists the allocation of instructional hours for science in Grades 6 to 9 of primary school.

Exhibit 1: Allocation of Instructional Hours in Science in Grades 6 to 9

Subject	Grades	Hours Per Week
Biology	7–9	2
Geography	6–9	2
Physics	8–9	2
Chemistry	8–9	2

The curricula for natural sciences, biology, physics, and chemistry for Grades 1 to 9 were changed from 2014 to 2016. The Bureau for the Development of Education has adapted the Cambridge International Assessment Curriculum for Macedonian learners. The Cambridge Curriculum Framework provides a comprehensive set of progressive learning objectives for these subjects for Grades 1 to 9. The objectives detail what students should know or be able to do in each grade. They provide a structure for teaching and learning and a reference against which students’ ability and understanding can be checked.

Scientific inquiry is about considering ideas, evaluating evidence, planning and recording investigative work, and data analysis. Scientific inquiry objectives underpin biology, chemistry and physics, and focus on developing confidence and interest in scientific knowledge. Environmental awareness and some history of science are also incorporated. The curricular framework provides a solid foundation for later stages of education.

The Cambridge Curriculum is founded on the values of the University of Cambridge and best practices in schools. The curriculum is dedicated to developing learners who are confident, responsible, innovative, and engaged. It is designed to engage students in an active and creative learning journey.

In Grades 1 to 4, science concepts are taught mainly within the subject of natural sciences.³ The main topics for each grade are:

- Grade 1—Ourselves, Pushes and Pulls, What Is It Made Of , Making Sounds, Living and Growing , Growing Plants
- Grade 2—Light and Dark, Looking at Rocks, Electricity, Space, Changing Materials, Plants and Animals Around Us
- Grade 3—Life Processes, Introduction to Forces, Materials, The Senses, Flowering Plants, Keeping Healthy
- Grade 4—Skeleton and Muscles; How Magnets Work; Making Circuits; Solids, Liquids, and Gases; Habitats; Sound

In Grades 5 to 8, science is taught within the following subjects: natural sciences in Grades 5 and 6, biology in Grades 7 and 8, geography in Grades 6 to 8, and physics and chemistry in Grade 8. Exhibit 2 lists the main science topics for Grades 5 to 8.

Exhibit 2: Main Science Topics for Grades 5 to 8

Subject	Grade	Topics
Natural Sciences	5	The Way We See Things; the Life Cycle of a Flowering Plant; Earth's Movements; Evaporation and Condensation; Investigating Plant Growth; Shadows
	6	Reversible and Irreversible Changes; Caring for the Environment; Human Organs and Systems; Growing Up; Conductors and Insulators; Food Chains; Forces and Motion
Biology ⁴	7	Cells and Organisms; Plants; Living Things in Their Environment
	8	Human Organ Systems; Circulation in Humans; Movement in Humans; Variation; Obtaining Food; Classification; Record in the Rocks
Geography ⁵	6	Space and Space Bodies; Earth and its orientation, lithosphere, water layer (hydrosphere), atmosphere, and biosphere
	7	Sociogeographic characteristics, economic and geographical characteristics, location in the immediate environment, population and settlements of the Republic of North Macedonia and its protection from pollution and degradation
	8	Natural geographical characteristics, sociogeographic characteristics and regional division of Europe, and geographical overview of regions in Europe (Southern, Western, Northern, Middle and Eastern)
Physics ⁶	8	Forces and motion; energy; light; the Earth and Beyond
Chemistry ⁷	8	States of matter; metals and nonmetals; elements, compounds, and mixtures; chemical reactions; introduction to the chemistry of carbon compounds

Professional Development Requirements and Programs

The Bureau for Development of Education is responsible for providing professional support to improvement efforts in primary schools, for professional development of school staff, and for accreditation of teacher training programs. At the end of the probation period, the probation appraisal is based on a mentor's report on the trainee teacher's teaching competencies. The National Examinations Center is responsible for organizing the professional administration of the teacher credentialing exam.

Two external agencies, the BDE and the State Education Inspectorate, evaluate teachers in the classroom and provide feedback for their improvement, if necessary. Almost every year, the BDE administers professional advancement seminars and workshops for teachers.

Monitoring Student Progress in Mathematics and Science

National assessments of mathematics were organized at the end of Grade 4 in 2000 and at the end of primary education (Grade 8) in 2006. Also, in 2006, a national assessment was carried out for Grade 4 in natural sciences. The aim of the national assessment was to provide the education administration and relevant institutions with valid data about student achievement that can be used in creating education policy and to give feedback to schools and teachers.

From 2014 to 2016, electronic external testing was carried out for all students from Grade 4 in elementary schools to year four in secondary schools.

The new law on primary education stipulates national assessment. A concept is currently being developed to define which students will be tested, in what sample, and in which subjects. The first live testing with this concept will be in 2021.

The state Matura exams are national level exams in secondary education for certification and selection for university entrance. They comprise four exams and a project.

The National Examinations Centre was established in 2009 (previously, it was the Assessment Unit within the BDE). The main purpose of this institution is to organize and conduct assessments in primary and secondary education.

Teachers evaluate student achievement through several forms of assessment, such as oral exams, written tests, etc. These tests are nonstandardized and prepared by teachers.

The results for students in Grades 1 to 3 are expressed in the form of descriptive grading, which includes the standards of knowledge the student has achieved. The upper grade students receive their results in numerical grades with additional verbal description. Numbers from 1 to 5 (1 = basic, 5 = excellent) are the most commonly used as summative marks for evaluation of student achievements in the third cycle (Grades 7 to 9). Upon completion of each grade, primary and secondary schools provide each student with a certificate that lists their final grades in each subject.

Special Initiatives in Mathematics and Science Education

From 2006 to 2011, the United States Agency for International Development (USAID) funded a large project for primary schools called the Primary Educational Project (PEP). One component of the project aimed to improve mathematics and science education. The main objective of this component was to help students build critical thinking skills to better prepare them for a knowledge-based global economy.

Another project was UNICEF's Early Literacy and early Numeracy Programme for Grades 1 to 3 from 2009 to 2015.

USAID's Readers and Leaders Project introduced two assessment instruments from 2013 to 2018 for students in Grades 2 and 3 in primary education: the Early Grade Reading Assessment (EGRA) and the Early Grade Mathematics Assessment (EGMA).

British Council's 21st Century School Programme (2018-2021) in all primary schools is designed to equip students aged 10-15 years with critical thinking and problem solving skills.

Suggested Readings

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