

Kazakhstan

Information-Analytic Center

Introduction

Overview of Education System

In accordance with the Constitution of the Republic of Kazakhstan, the state guarantees free secondary education (Grades 1 to 11 or 12) in state education institutions for all of its citizens.¹ The main principles of state education policy are the equal right of all citizens to receive quality education and the availability of education at all levels, taking into account the intellectual development, psychophysiological characteristics, and individual characteristics of every student.²

The Ministry of Education and Science of the Republic of Kazakhstan implements a unified state education policy, facilitates cross-sector coordination, and develops and implements state education and science programs.³ State education organizations are financed from budgetary funds in accordance with legislation of the Republic of Kazakhstan.

The education system of the Republic of Kazakhstan is based on the principles of consistency and continuity of curricula includes the following levels of education:

- Preschool education and training
- Primary education (Grades 1 to 4)
- Basic secondary education (Grades 5 to 9)
- Secondary education (general secondary education—Grades 10 to 11, and technical and vocational education)
- Post-secondary education
- Higher education
- Postgraduate education

Preschool education serves children up to age 6 or 7, and is provided at home or, one year before reaching school age, in preschool organizations. Preschool education is organized for children from age 5 as preparation for primary school. Preschool education is compulsory and is provided at home, by preschool organizations, or in preschool classes of comprehensive schools, *lyceums*, and *gymnasiums*. Preschool education in state education organizations is free of charge.

In accordance with the Law of the Republic of Kazakhstan on Education, the content of primary, basic secondary, and general secondary education is determined by general educational curricula and education programs. They are developed based on state compulsory education

standards.⁴ These standards determine the requirements for the content of education, the maximum workload for students, and the level of preparation of students.

In the 2016–2017 academic year, schools began a phased transition to updated content in primary, basic, and general secondary education. Students in first grade were the first to study under the new programs. Grades 2, 5, and 7 began the program in the 2017–2018 school year; Grades 3, 6, and 8 began in 2018–2019; and in the 2019–2020 school year, all grades except Grade 11 had transitioned to the program. In the academic year 2020–2021, all grades will be educated in accordance with updated programs.

Specialized education programs are being developed for gifted students to facilitate the full development of their potential, and have been implemented in 163 specialized schools for gifted children, *lyceums*, and *gymnasiums*.⁵ In 2018, there were 7,393 general secondary education organizations operating in the Republic of Kazakhstan, 7,014 of which were public schools. Kazakhstan is a country with a large territory. In each locality with a small population, the operation of small schools is guaranteed. The number of small schools in Kazakhstan is 2,886 (39 percent of all comprehensive schools).

In addition, 20 Nazarbayev Intellectual Schools have been established. These schools implement two educational models for students with high intellectual abilities: an integrated education program with a scientific-mathematical focus and the International Baccalaureate program.⁶

About 130 ethnic groups live in Kazakhstan. Kazakhs make up 66 percent of the population; Russians make up 21 percent; Uzbeks, Ukrainians, Uighurs, Tatars, Germans, Koreans, Azerbaijanis, Belarusians, Turks, Dungans, Poles, Kurds, Chechens, Tajiks, Bashkirs and representatives of other nationalities make up 13 percent. The state language of Kazakhstan is the Kazakh language. However, both Kazakh and Russian are officially used by state institutions and local authorities. English is used in an international context. The language policy in education organizations is conducted in accordance with the Constitution of the Republic of Kazakhstan and the legislation of the Republic of Kazakhstan on languages.⁷ Parents can choose the language of instruction for their children. In Kazakhstan, education is provided by 3,749 schools in Kazakh; by 1,195 schools in Russian; by 2,046 schools in both Kazakh and Russian; and by 24 schools in other languages (e.g., Uzbek, Uigur, Tajik).

Use and Impact of TIMSS

International comparative studies have played a key role in modernizing Kazakhstan’s education system. Kazakhstan’s participation in international studies is stipulated in the State Program for the Development of Education and is funded by the national budget. The country’s participation in such studies is invaluable. It not only enables the country to obtain objective data, it also gives the country a realistic assessment of achievement and problems in its education system.

TIMSS results are used to update the mathematics curriculum, to review teaching methods in mathematics and science at schools and universities, and to review teacher professional

development programs. For example, the I. Altynsarin National Academy of Education used the TIMSS conceptual model to develop education programs and school textbooks, and the National Center for Continuing Education “Orleu” developed special programs to support teaching staff in implementing international assessments of student achievement.

National experts are examining TIMSS released test items in depth. Two-stage assessments of student achievement were conducted from 2012 to 2014, taking into account TIMSS technologies. The same sample of students (Grades 5 to 6 and Grades 8 to 9) participated in the study both times. Parents also participated in the national study.

The Mathematics Curriculum in Primary and Lower Secondary Grades

State compulsory education standards define the goals and objectives of mathematics education at the primary, basic secondary, and general secondary levels.⁸

The objectives of mathematics education for students in primary education (Grades 1 to 4) are as follows:

- Grades 1 to 4—Students develop number sense through counting and measuring and learn the principles of writing numbers; learn to perform arithmetic operations with numbers verbally and in writing, solving for unknowns; learn to write and solve numerical expressions using rules of calculation; gain experience solving arithmetic problems; gain familiarity with simple geometric shapes, and the meaning of quantities and methods of measurement; learn arithmetic methods for solving word problems; learn to solve educational and practical problems using mathematics; and work with algorithms to perform arithmetic operations.

The updated mathematics curriculum in elementary school is divided into five sections that students study further at later levels of education:

- Numbers and Quantities
- Elements of Algebra
- Elements of Geometry
- Elements of Logic
- Math Modeling

To ensure continuity, the curriculum for primary education includes new subsections—Combinatorics, Sequences, Sets and Operations on Sets, and Fractions. It reinforces the previous subsection Geometric Shapes. The study of these subsections promotes the development of skills including logical thinking; analyzing processes and phenomena; and identifying cause-and-effect relationships, patterns, and development trends. TIMSS includes tasks of this type.

The objectives of mathematics education for students in general secondary education (Grades 5 to 9) are as follows:

- Grades 5 to 6—Students learn about rational numbers and their properties, arithmetic operations with rational numbers, and ordinary and decimal fractions; develop the ability to solve equations using knowledge of the interconnections of the components of arithmetic operations; learn to calculate using formulas; learn to solve problems involving proportions; learn to solve equations by using the commutative and associative properties of addition; learn to solve linear inequalities with one variable and their systems; learn to solve linear equations and inequalities with one variable, containing a variable under the sign of the module; learn to find the coordinates of points and plot points according to their coordinates on the coordinate line and on the coordinate plane; learn to solve a system of linear equations with two variables; and develop familiarity with planes, balls, and spheres.

Grades 7 to 9 offer two subjects:

- Algebra—Students learn how to perform arithmetic operations with polynomials, factor polynomials, use the formulas of abbreviated multiplication, perform actions on rational fractions, perform identical transformations of fractional rational expressions, prove identities, and find absolute and relative errors; learn to perform identical transformations of expressions containing square roots, solve square and fractional rational equations, and solve square inequalities using graphs of quadratic functions; and learn to solve rational inequalities using intervals.
- Geometry—Students develop familiarity with geometric shapes, including quantitative and qualitative relationships between components of one or more geometric shapes; develop deductive reasoning skills (direct proof, proof by contradiction), simple drawing and measurement skills, and the ability to represent a real object in the form of one or more geometric shapes; expand and systematize theoretical knowledge of properties of plane figures; develop ability to solve geometric problems of calculation, proof, and construction; expand ability to recognize geometric shapes in drawings of various degrees of complexity, using additional constructions and auxiliary drawings to solve problems; develop the ability to construct images of plane figures obtained during plane transformations, solving geometric problems using algebraic methods; develop familiarity with space and spatial figures; and develop familiarity with images of spatial figures and their components.

Basic mathematics content traditionally includes the following topics:⁹

- Numbers and Calculations—Natural numbers, ordinary and decimal fractions, percent and proportion, integers, rational numbers, irrational numbers, order of operations, indicators, finding roots, logarithms, sine, cosines
- Mathematical Expressions and Transformations—Variables, alphanumeric expressions, and identities and their use in transforming expressions; algebraic expressions (monomials, polynomials, and fractions) and arithmetic operations with integer and fractional algebraic expressions; trigonometric expressions

- Equations and Inequalities—Proofs of identity and inequality of expressions; equivalence in equations and inequalities; defining equations and inequalities; equations and inequalities with one and two unknowns and their geometric interpretations; rational inequalities; systems of equations and inequalities
- Functions—Numerical and elementary functions, their properties and graphs; arithmetic and geometric progressions
- Geometric Shapes and Their Properties—Points, line segments, rays, lines, planes, subspaces, angles, polygons, circles and circumference, polyhedral, and bodies of revolution; geometric relationships (parallelism, perpendicularity, equality, and symmetry); geometric values (line length, angle values, area, and volume); vectors and coordinates; using analytical tools in geometry
- Elements of Probability Theory and Statistics—Presenting statistical data (tables, diagrams, and histograms); calculating descriptive statistics (mode, median, average, range, and standard deviation); graphs; permutation; combinatorics; and geometric probability models

The Science Curriculum in Primary and Lower Secondary Grades

In the framework of updating the content of primary education, natural sciences in Grades 1 to 4 are taught through two courses: Knowledge of the World and Natural Science.

Knowledge of the World includes the following components:

- Nature—Living and nonliving objects and their properties; natural phenomena and their properties, conditions, and relationships; fauna and flora, including similarities, basic needs, breeding, and habitat
- Humans—The concept of humans as part of the natural world; significant features that distinguish humans from animals; the role of humans in the development of science, technology, the environment, and society
- Society—The homeland, family, school, and understanding of oneself and one's position in society

Natural Science in elementary school is designed to lay the foundation for the study of such subjects as biology, geography, chemistry, and physics. It is organized into the following sections:

- I am a Researcher—The role of science and researchers, methods of understanding nature
- Wildlife—Plants, animals, people
- Substances and Their Properties—Types of substances, air, water, natural resources
- Earth and Space—Earth, space, and time
- Physics of Nature—Forces and motion, light, sound, heat, electricity, magnetism

The content of each component or section is studied continuously from first through fourth grade and becomes increasingly complex from grade to grade.

In basic secondary education (Grades 5 to 9) and general secondary education (Grades 10 to 11 or 12), natural sciences are studied in the following subjects: geography (Grades 6 to 11), biology (Grades 6 to 11), chemistry (Grades 8 to 11), and physics (Grades 7 to 11).¹⁰ As part of the curriculum update, an additional subject—natural science—was introduced in Grades 5 and 6, as a continuation of the elementary school program.

- **Geography**—By the end of Grade 9, students should know about the Earth as one planet in the solar system; the size and shape of Earth; Earth’s continents; natural features of Earth that reflect its structure, space, and differences from other planets; processes and phenomena on Earth; material and spiritual cultural values that reflect human experiences of existence; types, structures, and characteristics of territories; the modern world and concepts related to sustainable development and the diversity of life; global, regional, and local problems of modern geography and environment and environmental issues.
- **Biology**—Across the grades, students learn the molecular, cellular, tissue, organismic, population, biogenetic and biosphere levels of life organization; the diversity of living organisms, their interaction, ontogenesis, phylogenesis, and evolution; systemic groups of organisms; the human as a biosocial person; fundamental biological theories (cellular, evolutionary, and chromosomal) and concepts (e.g., ecology and the origin of life). In Grades 6 to 9, students study living organisms, the diversity of organisms, evolution, flora and fauna in the environment; ecology and the biosphere; humans and their health; cell biology; the basics of genetics and natural selection, including heredity and human genetics and evolution.
- **Physics**—This topic area focuses on physical methods of studying nature, mechanics, molecular physics and thermodynamics, electrodynamics, atomic and nuclear physics, astrophysics. By the end of Grade 9, students should be aware of motion, the molecular structure of substances, thermal effects, direct current, the interactions of magnets, electromagnetic waves, the atomic nucleus, nuclear energy, and the structure and composition of the solar system.
- **Chemistry**—This topic area covers various organizational levels of substances, including simple and complex substances, pure substances, and mixtures; wide classes of organic and inorganic substances, natural and chemical polymers, and the theory of the chemical structure of substances; chemical reactions and their classifications; the periodic system of chemical elements; and the theory of electrolytic dissociation. By the end of Grade 9, students are studying atomic-molecular theory and the law of conservation of mass; physical and chemical changes; chemical elements and formulas, including atomic and molecular masses, oxygen, hydrogen, water, and air; the main classes of inorganic compounds; the periodic table of chemical elements; covalent and ionic bonds; electrolytic dissociation of acids, bases, and salts; physical and chemical properties of metals and nonmetals; and fundamental concepts of organic compounds

- Natural Science—This topic area focuses on the foundations of research, thinking, communication skills, and abilities: developing and proving hypotheses, drawing conclusions based on experimental data; formulating research questions and developing a research plan; collecting, describing, and evaluating data obtained during observations and experiments; drawing conclusions; working with natural science information from the media, internet, and scientific and popular science literature; owning the search methods, highlighting the semantic basis, and evaluating the accuracy of the information; presenting the results of a study in various forms; explaining the applied value of the most important achievements in natural sciences. Natural Science is an integrated course that forms the basis for further study of biology, geography, physics, and chemistry.

Professional Development Requirements and Programs

In accordance with the Law of the Republic of Kazakhstan On Education, teachers must participate in advanced professional development at least once every five years. In Kazakhstan, the system of advanced professional development for teachers has been restructured significantly by the JSC National Center for Continuing Education “Orleu” and its 17 regional branches (14 regions and 3 cities of republican significance). The updated guidelines and areas of study include:

- New approaches to teaching and learning
- Teaching critical thinking
- Assessment for professional development and assessment of professional development
- Use of Information and Communications Technology (ICT) in teaching and learning
- Teaching talented and gifted students
- Teaching and learning in accordance with the age-level characteristics of students
- Management and leadership in professional development

In addition, teachers participate in international and national conferences and professional development seminars, and national competitions are held annually, such as Best Teacher, Best Class Teacher, and the Altyn (Gold) Disk for ICT Teachers.

Special Initiatives

In accordance with the Law of the Republic of Kazakhstan on Education, in-depth science and mathematics education is one of the focus areas of school education. Students have the opportunity to receive in-depth training in science and mathematics in innovative institutions, including lyceums, schools for gifted children, specialized schools, and Nazarbayev intellectual schools in Kazakhstan.

In order to promote careers in science and mathematics, Kazakhstan actively takes part in international Olympiads, in addition to coordinating them.

Monitoring Student Progress in Mathematics and Science

To inform the development of education programs, education organizations carry out ongoing monitoring of student performance. In the future, a new form of intermediate certification of students is planned to replace the previous external assessment of educational achievement in primary school. Education organizations independently determine the method, order, and frequency of assessments. Currently, teachers in all academic subjects conduct assessments of student performance.

Per updates to the curricula, schools have transitioned to a new, criteria-based assessment system. This system enables students to form the ability to control and evaluate their activities, to establish and eliminate causes of any difficulties. The criteria-based assessment system includes formative and internal summative assessment. Formative assessment is carried out to collect data on learning progress. It serves to determine the level of mastery of knowledge and the formation of students' skills, enables adjustments to the education process, and is carried out by teachers who can provide feedback. A cumulative assessment is carried out to obtain information on student progress at the end of each section, across curricula, and at the end of each quarter. Assessment approaches may vary depending on subject matter and type of assessment. The Rules of the Ministry of Education and Science of the Republic of Kazakhstan stipulate that the number of cumulative assessments should not exceed three per day to prevent student overload. Upon completion of secondary school, graduates must pass final exams in the organization of education to obtain a certificate. Students seeking higher education must pass Unified National Testing (UNT) and Comprehensive Testing (CT) assessments at universities.

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