

Turkey

Burcu Parlak, PhD
Ahmet Yildirim, PhD
Emine Özdemir
Ministry of National Education

Introduction

Overview of Education System

In Turkey, the Ministry of National Education is responsible for planning, programming, executing, monitoring, inspecting, and assessing all education and training facilities.^{1,2} The Ministry of National Education has the following responsibilities:³

- To equip preprimary, primary, and secondary students with necessary physical, mental, moral, spiritual, social, and cultural qualities
- To plan, implement, and update education curricula and execute education services for students and teachers
- To develop national policies and strategies for every level of education, implement them, monitor their implementation, and update them when necessary
- To design an education system that is open to innovation, dynamic, and compatible with economic and social development needs
- To develop strategies to ensure that each citizen has an equal chance to access education services
- To ensure that female students and students needing special education have access to education services
- To develop and execute education programs and curricula for gifted students

Administrators at each level, including Ministry headquarters, central organizations, and provincial organizations, are answerable to upper management. Ministry and central organization administrators can delegate their authority to lower management, provided that they clearly define authority limits in a written document.⁴

Legislation on primary and secondary education enacted in 2012 extended the duration of compulsory education in Turkey to 12 years. This system is named the "4 + 4 + 4" Educational System, because it covers four years of primary school, four years of lower secondary school, and four years of upper secondary school. The basic structure of the Turkish national education system comprises preprimary education, basic education (including primary and lower secondary school),

upper secondary education (high school), and higher education.^{5,6} Exhibit 1 displays the general structure of the Turkish education system.⁷

Exhibit 1: The General Structure of the Turkish Education System

ISCED Level	Theoretical Starting Age	Grade	Education Program
8	24/25		Higher education—Doctoral programs
7	22/23		Higher education—Master's degree programs
6	18		Higher education—Bachelor's degree programs
5	18		Associate's degree diploma
3	13.5	12	Upper secondary education
		11	
		10	
		9	
2	9.5	8	Lower secondary education (basic education)
		7	
		6	
		5	
1	5.5*	4	Primary education (basic education)
		3	
		2	
		1	
02	3		Preprimary education (basic education)
01	0		Early childhood education and care

*As of June 2019, the age of school entry is 5.75 years.

ISCED = International Standard Classification of Education.

Preprimary education is not mandatory and serves children ages 3 to 5 who are not old enough to participate in primary education. Preprimary education may be provided in independent kindergartens or in nursery classes within a primary school affiliated with the Ministry of National Education. Moreover, some private schools and governmental schools/institutions are not affiliated with the Ministry of National Education. The aim of preprimary education is to ensure that children develop physiologically, mentally, and emotionally and acquire habits that help them prepare for primary education. In the 2018–2019 school year, there were 31,813 preprimary schools/institutions in Turkey, 6,577 of which were private. There were approximately 1.56 million preprimary school students (approximately 52 percent boys and 48 percent girls) and 93,302 teachers in total across the public and private school sectors.⁸

Basic education (ages 5 to 13) lasts eight years, is free of charge, and is compulsory. It is divided into primary education and lower secondary education, each of which lasts four years. Lower secondary education is provided in general lower secondary schools and lower secondary schools for imams and preachers. The objective of basic education is to ensure that Turkish children acquire the knowledge, skills, behavior, and habits to become good citizens, raised in accordance

with national morals, and to prepare them for life and the next level of education according to their interests, aptitudes, and competencies. In the 2018–2019 school year, there were 24,739 primary schools in Turkey, 1,808 of which were private. There were approximately 5.27 million primary school students (51.4 percent boys and 48.6 percent girls) and 300,732 teachers in total across the public and private school sectors. Additionally, there were 18,935 lower secondary schools in Turkey, 2,060 of which were private. There were 5,627,075 lower secondary school students (50.8 percent boys and 49.2 percent girls), and 354,198 teachers across the public and private school sectors.⁹

Upper secondary education (Grades 9 to 12) lasts four years. It is free of charge and compulsory. In Turkey, there are two types of upper secondary school: general high schools and vocational and technical high schools. Approximately 10 percent of the schools are selective and accept students based on a nationally standardized high school transition exam. This exam is administered to eighth grade students at the end of the school year and includes numerical and verbal tests. Numerical tests consist of mathematics and science tests, and verbal tests include Turkish language, religious culture and ethics, history of the Turkish revolution and Atatürk’s principles, and foreign languages tests.^{10,11}

High schools with a specific focus include Anatolian high schools, which emphasize English and mathematics; science high schools, which emphasize science; fine arts and sports high schools; and social science high schools. Vocational and technical high schools provide education and training leading to various careers. Although the curriculum differs according to each school’s purpose, the goals of upper secondary education, in accordance with the general purposes and basic principles of education established at the national level, are as follows:¹²

- To provide students with general knowledge about the world and to help them gain awareness about personal and social problems, seek solutions to these problems, and contribute to the economic and social development of the country
- To prepare students for higher education, an occupation, and life, considering their aptitudes and interests

Higher education includes all education institutions based on secondary education and lasts at least four semesters. Higher education institutions include faculties, graduate schools, colleges, conservatories within universities, and high technology institutes. The goals of higher education are as follows:¹³

- To train students in scientific thinking skills, and knowledge, skills, and competencies in an occupation, so that they may contribute to the development of the country
- To develop and implement education programs/curricula, so that the students can contribute to the economic, social, and cultural development of the country
- To conduct high-level scientific study and research, to produce knowledge and technology, and to contribute to national-level development

In 1963, the Scientific and Technological Research Council of Turkey (*TÜBİTAK*) was established as an autonomous institution to advance science and technology, conduct research, and support Turkish researchers. The council is responsible for promoting, developing, organizing, conducting, and coordinating research and development according to national priorities and targets. It advises the Turkish government on science and research issues and reports directly to the prime minister.¹⁴

Although Turkish education does not explicitly emphasize mathematics or science, it has promoted basic competencies in mathematics and science and related education policies since the revision of the primary and secondary school curricula in 2004. Accordingly, at the upper secondary level, science high schools emphasize mathematics and science considerably more than other high schools. In the 2018–2019 school year, there were 310 science high schools in Turkey.¹⁵

In 2015, the Ministry of National Education published a code on science and arts centers in Turkey. Science and arts centers aim to provide high quality, advanced education for gifted and talented individuals to enrich their formal education. There is at least one science and arts center in each province of Turkey. Science and arts centers are education institutions designed to enable gifted students to develop awareness of their individual talents and realize their potential fully without interrupting their formal education.¹⁶

Recently, the Ministry of National Education published Turkey's Education Vision 2023. This document sets forth a set of innovative goals aimed that the Ministry expects to achieve by 2023.¹⁷ Effects of this policy are expected to be observed in TIMSS 2023.

Use and Impact of TIMSS

Turkey participated in TIMSS 1999 and TIMSS 2007 at the eighth grade, and in TIMSS 2011 and TIMSS 2015 at both the fourth and eighth grades. TIMSS is one of several international indicators used to monitor education in Turkey. Educators in Turkey consider their students' scores and rankings on international assessments to be important reflections of their teaching. In this way, TIMSS and other international research projects affect curriculum development and education reforms indirectly.

The Mathematics Curriculum in Primary and Lower Secondary Grades

The vision of the current primary mathematics curriculum emphasizes educating students in the use of mathematics in their lives, to solve problems and to share solutions and ideas. In this context, the main purpose of the mathematics curriculum at primary level is to train students in mathematical literacy skills, to understand mathematical concepts and use these concepts in daily life. In addition, curriculum topics are prepared according to the developmental level of students in every grade. These strategies are intended to enhance students' active participation in learning mathematics and its principles.¹⁸

The curriculum emphasizes the importance of a learning environment in which students can express their thinking and reasoning in the problem solving process, and share and discuss

solutions. In addition, the curriculum highlights the importance of developing student’ skills in researching, producing, and using knowledge.¹⁹

Students are encouraged to develop metacognition skills and to manage their own learning processes consciously. With these processes, students’ systematic and responsible characteristics are expected to improve. The mathematics curriculum highlights conceptual and procedural understanding throughout primary school.²⁰ The philosophy of the education program is important for students to develop a positive attitude toward mathematics and develop a self-confident approach to mathematics problems.

The curriculum is designed to allow mathematics to be associated with other subjects and different disciplines within itself. It also emphasizes the importance of acquiring basic skills (e.g., problem solving, reasoning, communication, and connection) in mathematics teaching.²¹

The current primary school curriculum offers four learning areas in Grades 1 to 4: Numbers and Operations, Geometry, Measurement, and Data Processing. The distribution of content differs slightly for each grade and becomes more advanced as the grade level increases.

The Numbers and Operations learning area consists of natural numbers; addition, subtraction, multiplication, and division operations with natural numbers; fractions; and operations with fractions. Geometry covers geometric objects and shapes in geometry, spatial relationships, geometric patterns, and basic concepts in geometry. Measurement includes length, perimeter, area, time, weight and liquid measurement, currency, and simple shopping operations. Data Processing explains data collection and evaluation. Exhibit 2 presents these learning areas and their overall content across grades.

Exhibit 2: Mathematics Curriculum Learning Areas and Content, Grades 1 to 4

Learning Areas	Content
Numbers and Operations	Use numbers and digits; develop estimation and calculation skills by understanding the four arithmetic operations; associate fractions, percentages, and decimal fractions; determine relationships within patterns and apply this information to problem solving
Geometry	Develop spatial abilities; determine relationships between geometric shapes and objects; decorate with planar shapes; understand and use symmetry; use geometric tools and materials
Measurement	Gather, organize, and analyze data (probability is taught beginning in the fourth grade)
Data Processing	Perform estimations; develop an understanding of the concepts of measurement

There are five mathematics learning areas in Grades 5 to 8 (lower secondary school): Numbers and Operations, Algebra, Geometry and Measurement, Data Processing, and Probability. Exhibit 3 presents these learning areas and their respective content across grades.

Exhibit 3: Mathematics Curriculum Learning Areas and Content, Grades 5 to 8

Learning Areas	Grade 5 Content	Grade 6 Content	Grade 7 Content	Grade 8 Content
Numbers and Operations	<ul style="list-style-type: none"> ▪ Natural numbers and operations with them ▪ Fractions and operations with them ▪ Decimal notation ▪ Percentages 	<ul style="list-style-type: none"> ▪ Operations with natural numbers ▪ Operations with fractions ▪ Decimal notation ▪ Multipliers ▪ Sets ▪ Integers ▪ Ratios 	<ul style="list-style-type: none"> ▪ Operations using integers and rational numbers ▪ Percentages ▪ Rates and ratios 	<ul style="list-style-type: none"> ▪ Multipliers ▪ Exponents ▪ Square roots ▪ Real numbers
Algebra		<ul style="list-style-type: none"> ▪ Algebraic expressions ▪ Writing an algebraic expression suitable for a verbally given situation and a verbal situation suitable for a given algebraic expression 	<ul style="list-style-type: none"> ▪ Algebraic expressions ▪ Patterns and relations ▪ Equality and equations 	<ul style="list-style-type: none"> ▪ Linear equations ▪ Algebraic expressions and identities ▪ Inequalities
Geometry and Measurement	<ul style="list-style-type: none"> ▪ Basic geometric concepts and drawings ▪ Triangles and quadrangles, geometric objects ▪ Measuring area, time, and liquids 	<ul style="list-style-type: none"> ▪ Angles, geometric objects, circles ▪ Measuring angles, area, time, and liquids 	<ul style="list-style-type: none"> ▪ Lines and angles, polygons, circles ▪ Area of a circle ▪ Different aspects of objects 	<ul style="list-style-type: none"> ▪ Triangles, geometric objects, geometric transformations and projection ▪ Congruency ▪ Similarity
Data Processing	<ul style="list-style-type: none"> ▪ Creating research questions ▪ Data collection ▪ Using a frequency table and column chart and interpreting data 	<ul style="list-style-type: none"> ▪ Creating research questions for two sets of data ▪ Showing the data of two groups in a column chart ▪ Data analysis; smallest value, largest value, span, arithmetic mean 	<ul style="list-style-type: none"> ▪ Data analysis; line graphs, circle graphs, median, mode 	<ul style="list-style-type: none"> ▪ Data analysis ▪ Interpreting line and column charts of up to three data groups
Probability				<ul style="list-style-type: none"> ▪ Probability of simple events ▪ Determining the possible states of an event ▪ Events involving more, less, or equal probability ▪ Calculating the probability of a simple event

The Science Curriculum in Primary and Lower Secondary Grades

In Grades 1 to 3, primary school teachers teach a course called Knowledge of Life. However, the science content of this course is limited because teaching science is not the course's primary objective.²² In Grades 3 to 4, another course, Sciences, is taught and is compulsory. Primary school teachers teach Sciences in Grades 3 to 4, and science specialist teachers teach the course in Grades 5 to 8.

There are four learning areas in the science curriculum for Grades 3 to 8: Earth and Universe, Life and Living Beings, Physical Phenomena, and Matter and its Nature. Each of first four science learning areas includes several units that are developed in a spiral mode throughout the grades.²³ Exhibit 4 presents a summary of the science and technology content areas and their units in Grades 4 to 8.

The basic aims of science lesson curriculum are as follows:

- Gaining basic knowledge on astronomy, biology, physics, chemistry, Earth, and environmental sciences and science and engineering applications
- Adopting scientific process and research skills in the process of discovering nature, understanding the relationship between humans and the environment, and solving problems encountered in this area
- Raising awareness in interactions between individuals, the environment, and society and developing awareness of sustainable development regarding society, the economy, and natural resources
- Encouraging students to take responsibility for daily life problems and use information about science, scientific process skills, and other life skills
- Developing career awareness and entrepreneurship skills related to science
- Helping students understand how scientists obtain scientific knowledge and use it in research
- Arousing interest and curiosity in events occurring in nature and students' immediate surroundings
- Emphasizing the importance of safety in scientific studies
- Developing the ability to reason, scientific thinking habits, and decision making skills using sociological issues
- Ensuring the adoption of universal moral values, national and cultural values, and ethical scientific principles

Exhibit 4: Science Curriculum Learning Areas and Content, Grades 4 to 8

Learning Areas	Grade 4 Content	Grade 5 Content	Grade 6 Content	Grade 7 Content	Grade 8 Content
Earth and the Universe	<ul style="list-style-type: none"> ▪ The Earth's crust and motions of our Earth 	<ul style="list-style-type: none"> ▪ The Sun, Earth, and Moon 	<ul style="list-style-type: none"> ▪ The Solar System and eclipses 	<ul style="list-style-type: none"> ▪ The Solar System and beyond 	<ul style="list-style-type: none"> ▪ Seasons and climate
Life and Living Beings	<ul style="list-style-type: none"> ▪ Our foods, humans, and the environment 	<ul style="list-style-type: none"> ▪ World of living ▪ Humans and the environment 	<ul style="list-style-type: none"> ▪ Systems in our body ▪ Systems in our body and their health 	<ul style="list-style-type: none"> ▪ Cells and cell divisions ▪ Living things: reproduction ▪ Growth and development 	<ul style="list-style-type: none"> ▪ DNA and genetic code ▪ Energy conversions and environmental science
Physical Phenomena	<ul style="list-style-type: none"> ▪ Effects of forces, light, and sound ▪ Technology ▪ Simple electric circuits 	<ul style="list-style-type: none"> ▪ Measuring force and friction ▪ Diffusion of light ▪ Components of electric circuits 	<ul style="list-style-type: none"> ▪ Forces and motion ▪ Sound and its properties ▪ Conduction of electricity 	<ul style="list-style-type: none"> ▪ Forces and energy ▪ Interaction of light and matter ▪ Electric circuits 	<ul style="list-style-type: none"> ▪ Pressure ▪ Simple machines ▪ Electric charges and electric energy
Matter and Its Nature	<ul style="list-style-type: none"> ▪ Properties of matter 	<ul style="list-style-type: none"> ▪ Matter and change 	<ul style="list-style-type: none"> ▪ Matter and heat 	<ul style="list-style-type: none"> ▪ Pure substances and mixtures 	<ul style="list-style-type: none"> ▪ Matter and Industry

Beginning in fourth grade, content should include applications of science, engineering, and entrepreneurship. At the end of each school year, students are expected to present work that they created in that school year.

Professional Development Requirements and Programs

The Ministry of National Education Directorate of Teacher Training and Education is responsible for teachers' professional development in Turkey. When deciding what types of professional development to provide, the Ministry considers requests from other directorates, teachers, and school administrators, as well as new developments in the field. Each year, the Ministry's professional development department conducts a needs assessment, selects high priority topics, and develops a professional development plan. The Ministry then announces this plan to staff, including teachers and school administrators, on the Ministry Web page and sends official documents to schools. Teachers and school administrators also have an opportunity to register and participate in programs via the Internet. These programs, prepared by Minister, include special professional development programs for science, mathematics, and technology.²⁴

Monitoring Student Progress in Mathematics and Science

The Ministry of National Education is responsible for evaluating and assessing student performance in Turkey. The only national exam with consequences for individual students who

study in the schools affiliated with the Directorate of Basic Education is the High School Entrance Exam (*LGS*), given to eighth grade students transitioning from lower secondary to upper secondary education. The exam consists of two sections: numerical and verbal. The numerical section assesses mathematics and science concepts.

The other exam type is the Common Examination, conducted at the provincial level. This examination produces large scale, comparable data on student performance and feedback for students to better understand their proficiency gaps. There are two national assessment studies conducted to monitor student progress in Turkey. The National Assessment of Student Learning (*ABİDE*) has been developed to provide reliable and comparative data to measure learning outcomes against the national curriculum. It is conducted for mathematics, science, and the Turkish language for fourth and eighth grade students and mathematics, Turkish language and literature, physics, chemistry, and biology for 10th grade students. The other national assessment study is the Student Learning Achievement Monitoring assessment. It aims to provide schools with diagnostic information on students' strengths and weaknesses in Turkish, mathematics, and science.²⁵

Teachers' primary instructional strategies take advantage of multiple methods and techniques during all stages of teaching and learning.²⁶ The current curricula contain more student assessment instruments than previous curricula and adopt a multilevel, multifaceted measurement and assessment approach to student learning. Teachers are urged to use formative learning assessment and measurement techniques in addition to analytic and holistic evaluation methods, rather than typical paper and pencil tests. Assessment instruments include written examinations, oral examinations, projects, portfolios, journal writing, homework, quizzes, checklists, attitude scales, interviews, observations, posters, exhibitions, peer evaluations, and self-evaluations. Written examinations may include essays, multiple choice questions, short answer questions, and matching questions.²⁷

Special Initiatives in Mathematics and Science Education

Design-skills labs will be established at all basic education institutions according to the 2023 Education Vision. Schools will choose from among science, culture, art, sports, and life areas, to establish a lab according to local needs, environmental factors, teachers' characteristics and students' needs and capabilities. There are 11 labs, one of which is a science, technology, engineering, and mathematics (STEM) lab in which students can develop their skills in science, technology, mathematics, and mechanics. The design-skills labs are being piloted during the 2019–2020 school year. To reduce the achievement gap between schools, necessary educational measures will be taken to determine what kind of support each lab will provide. The initiative will include early childhood education materials and resources for children from disadvantaged households.²⁸

Currently, the Ministry of National Education has provided support for many students from disadvantaged households, including free schoolbooks, scholarship programs, and Conditional Education Aid, to ensure equal opportunities for all students. In addition, the Ministry of National

Education administers the State Free Boarding and Scholarship Test for secondary school and high school students. Students who pass this test earn a Scholarship or can benefit from free accommodations.²⁹

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