Hungary

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Introduction

Overview of Education System

According to Act CXC of 2011 on National Public Education,[1] the state ensures the provision of public education, with the exception of preschools. The state provides public education by establishing and operating institutions and by working with churches or private institutions through public education agreements. Local governments ensure the provision of preschool education by establishing and operating institutions or by means of public education agreements. Overall responsibility lies with the Ministry of Human Capacities, which is in charge of public education, culture, social affairs, health care, youth, and sports. However, school-based vocational education and training and higher education is within the competence of the Ministry for Innovation and Technology.

The government is authorized to regulate the introduction and implementation of the national curriculum. Public education institutions are professionally independent—they make decisions regarding their own organization and operation on matters not regulated legally by any other entity.

Exhibit 1 presents the structure of the Hungarian education system by age, grade, and International Standard Classification of Education (ISCED) 2011 level.

Crèche (nursery) is a noncompulsory welfare institution serving children ages 20 weeks to 3 years, providing professional daycare and fostering child development. Since September 2015, preprimary education has been compulsory for children ages 3 to 6. Previously, enrollment had been mandatory at age 5, although children generally were enrolled in preprimary education at age 3.

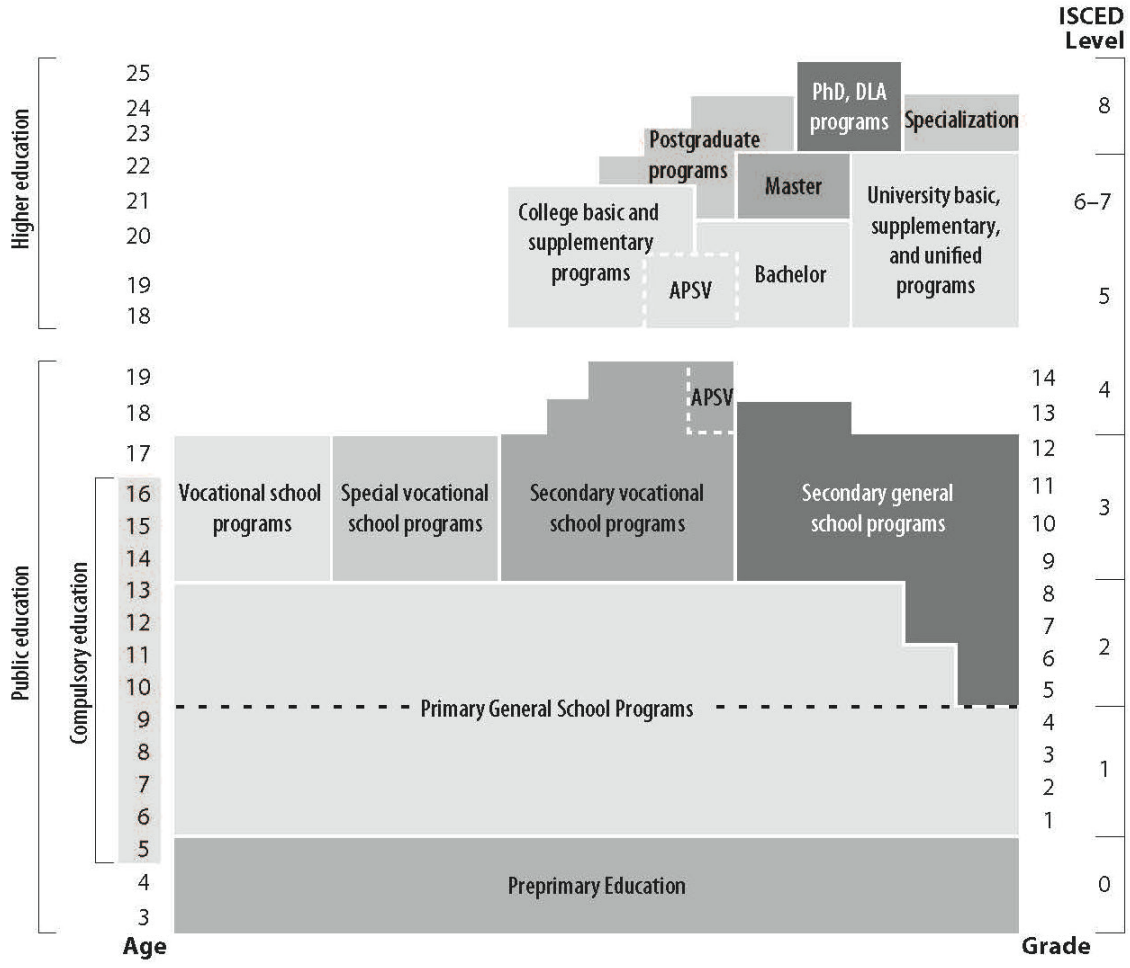
Primary and lower secondary education (ISCED 1, 2) is organized as a single-structure system in eight-grade basic schools (typically for students ages 6 to 14, Grades 1 to 8). Upper secondary education (ISCED 3, typically for students ages 14 to 18, Grades 9 to 12) is provided by general secondary schools, secondary vocational schools, vocational schools, or vocational school for special education. General secondary schools are allowed to offer longer programs starting earlier, from Grade 5 or 7.

Secondary general schools provide general education and prepare students for the secondary school leaving examination, which is a prerequisite for admission to higher education. Secondary vocational schools provide general and prevocational education, prepare students for the

secondary school leaving examination, and offer vocational post-secondary nontertiary programs (ISCED 4 C). Vocational schools provide general, prevocational, and vocational education and may also provide remedial lower secondary general education for those who have not completed basic education. Students can continue their studies to acquire an upper secondary general school examination certificate after finishing their vocational program.

Higher education programs (ISCED 5A, 5B, 6) are offered by public or private universities and colleges. In accordance with the three-cycle Bologna degree structure, there are bachelor's degree programs lasting six to eight semesters (ISCED 5A, 180 to 240 European Credit Transfer System [ECTS] credits) that can be followed by master's degree programs (ISCED 5A, 60 to 120 ECTS credits) lasting another two to four semesters. The third cycle provides doctoral studies (ISCED 6). There are also continuous long programs (10 to 12 semesters, 300 to 360 ECTS credits, ISCED 5A) for some disciplines, such as medicine or law.[2]

Exhibit 1: Structure of the Hungarian Public Education and Higher Education System by Age, Grade, and ISCED Level



APSV = Accredited post-secondary vocational

Use and Impact of TIMSS

Hungary has participated in every TIMSS cycle and has been an above average performer in each. Despite this history, TIMSS is not widely known in Hungary; its media attention is moderate compared with, for example, the Programme for International Student Assessment (PISA), appearing mainly in education publications. The increased focus on PISA may be due to unsatisfactory results from PISA that surprised the public in 2001.

On December 6, 2016, the Ministry of Human Capacities, the Educational Authority, and the *Eötvös Lóránd* University held a press conference on the findings from TIMSS 2015 and PISA 2015, focusing on international and Hungarian results. The Hungarian TIMSS team published an online report releasing the results of fourth and eighth grade students in TIMSS 2015 with a focus on Hungarian results.[3]

Partly due to the impact of international large scale studies, in 2001, Hungary implemented the National Assessment of Basic Competencies (NABC), an assessment system focused on reading and mathematical literacy (a new area of science is under development), and experimented with competency-based educational programs. It has become common knowledge that the development of mathematical literacy is vital to further education, success in the labor market, and personal growth. The understanding of teaching and learning has undergone a paradigm shift, making the aim of education developing students' personal abilities and competencies rather than promoting their encyclopedic knowledge.

An article comparing the mathematics components of the TIMSS 2015 and NABC 2015 assessments revealed crucial differences between the two constructs, although the two tests use similar content and cognitive categorizations.[4] While TIMSS is based broadly on common elements of the mathematics curricula of participating countries, NABC intends to measure students' ability to use mathematical knowledge and competencies in real life situations. The correlation between the TIMSS and NABC mathematics test results also confirms that the assessments test related measures but not identical abilities. The article evaluated the representativeness of the TIMSS sample using school- and class-level weight factors of TIMSS and the student-level weights of NABC. It revealed a very good match with no statistically significant differences in the mean and standard deviation of the sample and the full cohort. The analysis confirms that estimations of population parameters based on TIMSS samples are of a good quality.

The Mathematics Curriculum in Primary and Lower Secondary Grades

According to Act CXC of 2011 on National Public Education,[5] the new national curriculum came into effect on September 1, 2013, implementing a spiral approach for Grades 1, 5, and 9. The National Core Curriculum (NAT) is a basic document that regulates the education process, specifying the content to be acquired for each subject and the skills to be developed. The Framework Curriculum is an intermediate regulator between local curricula and the NAT. It specifies the knowledge content to be acquired and the output requirements for each pedagogical phase (two-year cycle).

Exhibits 2 and 3 present the expected competencies acquired in mathematics by the end of Grades 4 and 8, according to the Framework Curriculum.[6]

Exhibit 2: Expected Mathematics Competencies by the End of Grade 4

Area	Expected Competencies
Methods of thinking and cognition	▪ Sorting into sets based on various criteria ▪ Recognizing and describing common characteristics of elements in a set ▪ Deciding whether a given object belongs to a given set ▪ Interpreting changes in a simple text with mathematical content ▪ Ordering a few elements, finding all cases (by repeated trials)
Number theory, algebra	▪ Reading and writing numbers (up to 10,000) ▪ Place values, digits, and real values (up to 10,000) ▪ Negative numbers in everyday life (temperature, debt) ▪ Fractions in everyday life: writing; expressing with words; modeling fractions with 2, 3, 4, 10, and 100 as the denominator with folding, cutting/shearing, drawing, painting ▪ Comparing natural numbers up to 10,000 ▪ Recognizing the relationship between quantities in activities ▪ Applying correct and meaningful estimation and rounding in different fields of mathematics ▪ Mental calculations up to 100 ▪ Exact knowledge of multiplication chart up to 100 ▪ Calculation without calculators up to 10,000 in simple cases with numbers ending zero ▪ Sums, differences, product, quotients ▪ Applying properties of operations, commutative property of addition and multiplication, knowing and applying order of operations ▪ Adding and subtracting four-digit numbers, multiplying with two-digit numbers, and dividing with one-digit numbers in writing ▪ Checking of operations ▪ Word problems: interpreting text, collecting data, solution plans, estimation, verification, interpreting results ▪ Knowing concept of multiples, divisors, remainders
Relationship, functions, sequences	▪ Recognizing and following rules, recognition and creation of increasing and decreasing numerical sequences ▪ Finding relationships between terms of simple sequences ▪ Establishing a rule in simple form, continuing/complementing missing terms
Geometry	▪ Recognizing relative position of intersecting and parallel lines ▪ Standard units of measurement: mm, km, ml, cl, hl, g, t, s ▪ Simple conversions between neighboring units ▪ Measuring length, distance, and time (simple examples in practice) ▪ Creation, recognition, and characteristics of triangles, squares, rectangles, polygons ▪ Experimental knowledge of the concept of circle ▪ Understanding difference between solids and shapes ▪ Creation, recognition, and characteristics of cubes and cuboids ▪ Recognition of a sphere ▪ Creating figures with reflection, and reflection of symmetry by folding, cutting/shearing, drawing, and painting

Area	Expected Competencies
	▪ The perimeter and area of squares and rectangles ▪ Measuring the area of squares and rectangles by different units, covering the area
Statistics, probability	▪ Noting experimental data and entering it into a table, reading tables ▪ Collecting and recording data, reading diagrams ▪ Interpreting probability-based games, experiments; experimental knowledge of "certain," "impossible," "possible but not certain"
Information technology	▪ Using age-appropriate educational software with teacher assistance ▪ Using drawing software to create and paint simple drawings ▪ Cooperation using interactive whiteboard

Exhibit 3: Expected Mathematics Competencies by the End of Grade 8

Area	Expected Competencies
Methods of thinking and cognition	▪ Sorting elements into sets ▪ The truth content of simple statements, the logical value of statements, negotiation of statements ▪ Clear, accurate communication of statements, assumptions, choices, interpreting simple texts with mathematical content ▪ Solving exercises in combinatorics by finding and listing all cases systematically ▪ Using binary trees in solving exercises
Number theory, algebra	▪ Exact calculation knowledge with rational numbers ▪ Knowledge and the reliable application of the order of operations and parentheses ▪ Estimating results, using estimation for checking, correct and meaningful rounding ▪ Measurement, the use of measurement units, conversion ▪ Proportionality, inverse proportionality ▪ Basic concepts of percentage calculation, applying formulas in solving exercises ▪ Choosing the greatest common divisor from the divisors and the least common positive multiple from the multiples ▪ Prime numbers, composite numbers, prime decomposition ▪ The substitution value of simple algebraic integer expressions ▪ Adding, subtracting terms; multiplying polynomials with several terms by polynomials with one term ▪ Squaring, calculating square roots, exponentiation of integers with positive integer exponents ▪ Linear equations and inequalities with one variable ▪ Solving simple word problems from mathematics and used in everyday life with deduction and equations, verification, representing the solution on a number line ▪ Using expressions and operations with them to solve exercises in mathematics, science, and everyday life ▪ Reasonable usage of calculator to make computation easier
Relationships, functions, sequences	▪ Continuing sequences according to a known rule ▪ The graphical representation of proportionality, applying knowledge about linear relationships in exercises in science ▪ Analyses of graphs according to the aspects previously studied, drawing graphs, reading data from graphs ▪ Reading, interpreting data in a table; representing data using graphs

Area	Expected Competencies
Geometry	▪ Making figures and exact constructions based on geometrical knowledge ▪ Knowing characteristics of studied geometrical figures (the sum of the interior angles of the triangle and the quadrilateral) ▪ Symmetry properties of special quadrilaterals and applying them in solving exercises ▪ Reflection symmetry and point symmetry, translation by construction ▪ Recognizing reduction and enlargement in everyday situations (without construction) ▪ The Pythagorean theorem and its application in calculations ▪ Calculating the perimeter and area of triangles and special quadrilaterals and the circumference and area circles ▪ Knowing the formula for the volume of previously studied three-dimensional shapes (triangular and rectangular right prisms, right circular cylinders) and calculating volume of three-dimensional shapes used in everyday life
Statistics, probability	▪ Probability experiments, noting the results, frequency, calculation of relative frequency ▪ Understanding chance and probability in concrete calculation exercises, recognizing certain and impossible events
Other knowledge	▪ Rational use of calculators in probability calculations ▪ Famous Hungarian mathematicians in history, their areas of research and findings

The Science Curriculum in Primary and Lower Secondary Grades

According to Act CXC of 2011 on National Public Education,[7] the new national curriculum came into effect on September 1, 2013, implementing a spiral approach for Grades 1, 5, and 9. NAT is a basic document that regulates the education process, specifying the content to be acquired for each subject and the skills to be developed. The Framework Curriculum is an intermediate regulator between local curricula and NAT. It specifies the knowledge content to be acquired and the output requirements for each pedagogical phase (two-year cycles).

Exhibits 4 and 5 present the expected competencies developed in science at the end of Grades 4 and 8, according to the Framework Curriculum.[8] In Grade 4, science is made up of integrated natural sciences, while in Grade 8, science comprises physics, chemistry, biology, and Earth and the Environment.

Exhibit 4: Expected Science Competencies by the End of Grade 4

Subject	Expected Competencies
Integrated natural sciences	▪ Applying the basic elements of a healthy lifestyle for health preservation, healthy development, and disease prevention ▪ Behaving responsibly and safely in emergency situations ▪ Measuring time and length, estimating time and length in everyday situations ▪ Engaging in planned observations of nature and studying simple experiments on natural phenomena ▪ Explaining the importance of a sustainable lifestyle by examples, interpreting the role of tradition in building a harmonic connection with nature ▪ Demonstrating the organization levels of living creatures and connections of ecosystems, classifying living creatures ▪ Demonstrating a natural ecosystem ▪ Classifying materials according to their properties, uses, and effects and recognizing the most responsible uses and methods of disposal for them ▪ Locating Hungary geographically, knowing its main cultural and natural values ▪ Using Information and Communications Technology with guidance to find information and solve problems

Exhibit 5: Expected Science Competencies by the end of Grade 8

Subject	Expected Competencies
Physics	▪ Symbols and units of physical quantities (length, volume, mass, density, temperature, time, pressure, atmospheric pressure, force, weight, voltage, electric current), using equipment to measuring those quantities, converting familiar units ▪ States of water, the role that changes in states of matter plays in everyday life ▪ Features of sound and light, the physical processes of hearing and seeing sound and light, recognizing light and sound pollution in everyday life, the importance of ultrasound, how cameras and telescopes work, the equipment of space exploration ▪ Energy sources used in households and traffic, the necessity of saving energy, the concept of sustainable development ▪ Characterizing simple motions in traffic and everyday life, knowing the relationship between change in velocity and force, using knowledge to explain how a vehicle's velocity changes ▪ Knowing the objects of the Solar System, having knowledge about the structure of the Universe, understanding the difference between astrology and astronomy ▪ Weather phenomena and natural disasters, identifying the human activities causing environmental pollution and nature damage ▪ Using knowledge of electric current when using household equipment, including its risks and dangers ▪ Using Information and Communications Technology for collecting, ordering, representing information about physics; representing measurement data on tables and graphs ▪ Explaining school experiments and making connections between classroom experiences and personal experiences of everyday physical phenomena

Subject	Expected Competencies
Chemistry	▪ Scientific thinking: science results, knowledge, work of scientists, inventions ▪ Modeling as a scientific method, recognizing its boundaries; responsibly implementing simple chemical experiments, comparing results with previous experiences and knowledge; recognizing physical changes (change of state, dissolution, sieving, distillation, absorption) and distinguishing them from chemical changes ▪ Familiarity with the periodic table, computation in simple cases based on the amount of substances and chemical equations ▪ Basic knowledge about metals and nonmetals important in everyday life, their compounds, usage, and biological effects ▪ Macromolecules of life and their most important properties ▪ Recognizing typical chemical changes and classifying them by given aspects ▪ Knowing that living and nonliving things are made up of atoms; the structures determine the properties; the conservation of mass, energy, and electric charge is always in effect; and these processes (usually) process seek to find the energy minimum
Biology	▪ Understanding reasons for the formation of climate zones and the relationship between the composition of biomes and the environmental factors characterizing an area ▪ Knowing the dangers of global environmental damage, understanding that diversity and biodiversity are valuable ▪ Knowing and characterizing the most important species of ecosystems by appropriate algorithm, constructing the food chain from them ▪ Giving examples for the most common forms of interaction between organisms ▪ Describing the structure of ecosystems, the similarities and differences in their spatial arrangement; knowing the reasons of their diversity and change ▪ Distinguishing between grouping and classifying, knowing the basics of the biological systematics; knowing the typical kingdoms, phylum, and classes of living organisms based on their morphological characteristics and being able to locate them in the evolutionary systematics (up to class level) ▪ Understanding the relationship between the structure and function of cells, tissues, and organs; the relationship between cellular and organ systems' life processes. ▪ Knowing the advantages and disadvantages of sexual and nonsexual reproduction, their role in the survival of species and in maintaining the diversity of life on earth ▪ Knowing the structure and basic functions of the human body, the difference between a male and a female, and the biological-psychological challenges of adolescence ▪ Knowing the causes of diseases, their prevention and recognition, and the most important rules of a healthy lifestyle and first aid; understanding the importance of screening tests ▪ Observing and investigating experiments individually or in group, recording and reporting on findings; familiarity working with microscopes

Subject	Expected Competencies
Earth and the Environment	▪ Having an overall, realistic picture of the Earth and its geography (continents, oceans, landscapes, and economically important countries); having an overall knowledge of our continent, neighboring countries' geography, and social geography; perceiving the determinative role of geographical factors in lifestyle ▪ Recognizing the relationships and laws in the formation of geographical zonality ▪ Giving examples for effects of socioeconomic processes causing environmental damage, local problems with global consequences ▪ Knowing the effects of the changing environment on humans ▪ Having a realistic picture of environmental conditions, data, and changes in time; knowing the basics of the timeline of the Earth's history; being able to observe natural and socioeconomic phenomena; collecting and summarizing information from printed or electronic documents and highlighting important elements using digital knowledge; being able to describe climate zones, continents, countries and typical landscapes by given aspects ▪ Using maps as a source of information, being able to link geographic and environmental content to topographic knowledge; using topographic knowledge to orient in geographical space and on maps and apply topographic knowledge when studying other subjects; being able to collaborate; developing a curiosity for expanding geographical knowledge individually later in life

Professional Development Requirements and Programs

According to Act CXC of 2011 of the National Public Education and Government Decree 277/1997 on teacher in-service training, teacher examinations, and the benefits and reductions provided for participants in in-service training, teachers are required to participate in at least 120 hours of professional development every seven years.[9] School principals have the option of reducing teacher workloads if the teachers are involved in in-service training programs. Subject examination preparatory courses are the most common form of professional development. These classes usually cover education management, pedagogy, and professional services. Assessment and evaluation courses are also popular.

In 2013, a life career model was introduced for teachers.[10] Under this system, teachers are classified based on their qualifications and years of teaching experience according to the following stages: Intern, Teacher 1, Teacher 2, Master Teacher, and Teacher Researcher. To obtain Teacher 2 status, teachers must upload their portfolio (comprising their professional record, lesson plans, and other materials), pass a performance evaluation consisting of classroom observation by visiting inspectors, and then present their portfolios. Based on these components of evaluation, the Educational Authority issues a certificate, and teachers may advance within the system.

Monitoring Student Progress in Mathematics and Science

Since the 2001–2002 academic year, Hungary has administered its National Assessment of Basic Competencies[11] every year (except in the 2004–2005 academic year) to assess student performance in mathematics and reading. Since 2004, all students in Grades 6, 8, and 10 have taken part in the testing. The assessment measures students' ability to use their skills and knowledge to solve

problems modeling everyday situations and does not focus on textbook knowledge. In 2014, a revised framework for the NABC[12] was published. The NABC provides benchmarks for student performance in seven levels of competency. School level results are published on a public website nine months after the assessment, while schools and the organizations responsible for them receive additional data analysis software that enables them to study student performance in more detail. Since 2008, the implementation of assessment IDs has made it possible to track individual student development from Grade 6 through Grade 10.

The National Public Education Act guarantees the annual administration of the tests and requires schools to monitor their performance as part of their quality control programs. To reduce disadvantages caused when children develop at different rates, a mandatory assessment of first grade students' basic competencies was introduced during the 2006–2007 academic year. The Ministry of Education provides all educational institutions with a free evaluation kit called the Diagnostic Development System.[13] The evaluation kit is designed to measure student social development and skills, elementary arithmetic, fine motor coordination for writing, and comprehension of and vocabulary for relationships.

In addition to these assessments, student performance and progress are evaluated regularly with numeric grades. Teachers evaluate student performance and progress regularly throughout the school year. Students and parents are notified regularly with grade reports. Teachers use interim grades to determine midterm and final grades. Schools communicate grades to students and parents with a note at the end of each term and in school reports at the end of the year. Grades for student knowledge are based on the following scale: Excellent (5), Good (4), Average (3), Satisfactory (2), and Unsatisfactory (1).

In Grade 1 at midterm and at the end of the year, and in Grade 2 at midterm, teachers present a written evaluation of student progress, describing it as Excellent, Good, or Sufficient and noting if the student requires tutoring.

Students can take noncompulsory mathematics and reading examinations in Grades 4, 6, and 8 provided by the Educational Authority. The examinations in Grades 4 and 6 are part of the examinations used for entrance to secondary general schools starting from Grade 5 or 7. The results of the examination in Grade 8 are part of the examination used for entrance to most secondary schools.

Special Initiatives in Mathematics and Science Education

The government funded National Talent Programme project *Matalent* aims to identify and facilitate special development for students talented in mathematics. The program consists of a methodology established for identifying talented mathematics students in Grade 4, along with accompanying test materials and analytical tools. Talented students identified are offered access to mathematics related programs.

Suggested Readings

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