Bosnia and Herzegovina

Branka Popić
Svjetlana Bjelić, translator
Agency for Preprimary, Primary and Secondary Education

Introduction

Overview of Education System

The education system in Bosnia and Herzegovina (BiH) reflects the organization of the State as defined by the Constitution of the Federation of Bosnia and Herzegovina, the constitutions of the individual entities and cantons, and the Statute of Brčko District of Bosnia and Herzegovina, which legally define responsibilities with respect to education. Hence, Republika Srpska, 10 cantons in the Federation of Bosnia and Herzegovina (FBiH), and Brčko District of Bosnia and Herzegovina have full and undivided responsibility for education in their respective regions. Institutions that are registered under the applicable laws in Bosnia and Herzegovina and that provide services in preschool, primary, secondary, and adult education (hereinafter: schools) and other professional educational institutions are obliged to apply and respect the principles and norms set out in the Framework Law on Preschool Education[a] and the Framework Law on Primary and Secondary Education,[b] and provide equal education for all children and students.

Education in Bosnia and Herzegovina is highly decentralized and is not the responsibility of the State. Instead, responsibility for the education process is at the level of entities, cantons, and in some cases, local government (as in the case of preschool education).

There are 13 ministries of education in Bosnia and Herzegovina: two ministries at entity levels, one ministry in Brčko District, and 10 ministries across the cantons. In addition, the Ministry of Civil Affairs has an education sector with a coordinating role at the State level.

In Republika Srpska, the Ministry of Education and Culture of Republika Srpska is responsible for the education sector,[c] while in FBiH, there are 10 ministries of education:

1. Ministry of Education, Science, Culture and Sports of Una-Sana Canton[d]
2. Ministry of Education, Science, Culture and Sports of Posavina Canton[e]

a See https://aposo.gov.ba/sadrzaj/uploads/Okvirni-zakon-o-pred%C5%A1kolskom-odgoju-i-obrazovanju-u-Bosni-i-Hercegovini.pdf for more information.

b See https://www.paragraf.ba/propisi/bih/okvirni-zakon-o-osnovnom-i-srednjem-obrazovanju-u-bosni-i-hercegovini.html for more information.

c See https://vladars.rs/sr-SP-Cyrl/Vlada/Ministarstva/mpk/Pages/default.aspx for more information.

d See https://vladausk.ba/v4/index/ministarstvo-obrazovanja-nauke-kulture-i-sporta/2 for more information.

e See https://www.zupanijaposavska.ba/ministarstvo_prosvjete-znanosti-kulture-i-sporta/ for more information.

3. Ministry of Education and Science of Tuzla Canton[f]
4. Ministry of Education, Science, Culture and Sports of Zenica-Doboj Canton[g]
5. Ministry of Education, Youth, Science, Culture and Sports of Bosnian-Podrinje Canton Goražde[h]
6. Ministry of Education, Science, Youth, Culture and Sports of Central Bosnia Canton[i]
7. Ministry of Education, Science, Culture and Sports of Herzegovina-Neretva Canton[j]
8. Ministry of Education, Science, Culture and Sports of West Herzegovina Canton[k]
9. Ministry of Education of Sarajevo Canton[l]
10. Ministry of Science, Education, Culture and Sports of Canton 10[m]

In FBiH, there is also a Federal Ministry of Education, mainly with a coordinating role.[n] The Department of Education in Brčko District acts as the ministry of education and is responsible for education in this part of Bosnia and Herzegovina.[o]

According to the Law on Ministries and Other BiH Administration Bodies,[p] the Ministry of Civil Affairs of Bosnia and Herzegovina is responsible for performing tasks within the competence of Bosnia and Herzegovina related to the basic principles of coordination. The Ministry of Civil Affairs of Bosnia and Herzegovina exchanges data with domestic and international institutions in the field of education based on European Union (EU) and international reforms and strategic documents, laws, and bylaws for all levels and types of education.[q]

Pedagogical institutes are established as independent educational institutions or under the jurisdiction of the ministries in the canton/entity or district to which they belong. There are nine pedagogical institutes in Bosnia and Herzegovina in the following administrative units:

- Pedagogical Institute of Republika Srpska[r]
- Pedagogical Institute of Una-Sana Canton[s]
- Pedagogical Institute of Tuzla Canton[t]

f See https://montk.gov.ba/ for more information.
g See https://zdk.ba/ministarstva/ministarstvo-za-obrazovanje-nauku-kulturu-i-sport for more information.
h See https://mo.bpkg.gov.ba/ for more information.
i See https://mozks-ksb.ba/ for more information.
j See https://monkshnk.gov.ba/Index/hr for more information.
k See https://mozkszzh.gov.ba/ for more information.
l See https://mo.ks.gov.ba/ for more information.
m See https://www.vladahbz.com/ministarstvo-znanosti-prosvjete-kulture-i-sporta/ for more information.
n See http://www.fmon.gov.ba/ for more information.
o See http://www.ob.bdcentral.net/ for more information.
p See https://www.ohr.int/ohr-dept/legal/laws-of-bih/pdf/009%20-%20PUBLIC%20ADMINISTRATION/Ministries/BH/BH-LAW-ON-MINISTRIES%205-03.pdf for more information.
q See http://www.mcp.gov.ba/Content/Read/obrazovanje for more information.
r See https://www.rpz-rs.org/ for more information.
s See https://www.pzusk.ba/ for more information.
t See http://pztz.ba/ for more information.

- Pedagogical Institute of Zenica-Doboj Canton[u]
- Pedagogical Institute of Bosnian-Podrinje Canton Goražde[v]
- Pedagogical Institute of Mostar[w]
- Institute for Education, Mostar[x]
- Pedagogical Institute of Brčko District[y]
- Institute for Preuniversity Education, Sarajevo Canton[z]

The Institute for Education was established in an agreement between the West Herzegovina Canton and Canton 10. The institute began its work as an independent public institution with the basic task of providing professional support within the education system.

According to law, the Agency for Preprimary, Primary and Secondary Education (APOSO) operates at the State level.[aa] APOSO is responsible for establishing learning standards; evaluating results; developing the Common Core Curricula (CCC) for preschool, primary education, and secondary education; and developing other specialized activities regarding learning standards and evaluation of education quality in accordance with special laws and other regulations. In cooperation with the competent education authorities in Bosnia and Herzegovina, APOSO is also responsible for conducting large-scale international education surveys (including Programme for International Student Assessment [PISA] 2018, TIMSS 2019, TIMSS 2023, and International Computer and Information Literacy Study [ICILS] 2023 to date) and for developing reports and recommendations to improve the education system in Bosnia and Herzegovina.

Education systems in Bosnia and Herzegovina comprise four levels of education. However, in order to make these levels comparable to other countries' education systems, Bosnia and Herzegovina follows the International Standard Classification of Education (ISCED) (see Exhibit 1).

Exhibit 1: Levels of Education in Bosnia and Herzegovina

ISCED Level	Corresponding Level in Bosnia and Herzegovina
0	preschool education
1	lower grades of primary school, Grades I–V
2	upper grades of primary school, Grades VI–IX
3	secondary education, Grades I–III
4	secondary education, Grades I–IV
5	postsecondary education, including craftsmen and related exams

u See https://pedzavodzenica.ba/en/home/ for more information.
v See https://pzbpkgorazde.ba/ for more information.
w See http://zavod-skolstvo.ba/ for more information.
x See http://zavod-zzoo.com/ for more information.
y See https://ob.bdcentral.net/Content/Read/pedagoska-institucija for more information.
z See https://irpo.ba/ for more information.
aa See https://aposo.gov.ba/en/ for more information.

Exhibit 1: Levels of Education in Bosnia and Herzegovina (Continued)

ISCED Level	Corresponding Level in Bosnia and Herzegovina
6	higher education program (bachelor's degree)
7	higher education program (master of science/specialist qualification degree)
8	higher education program (doctor of science degree)

Primary education is compulsory, free of charge, and delivered through classrooms offering class teaching in Grades 1 to 3, class and subject teaching in Grades 4 to 6, and subject teaching in Grades 7 to 9. Compulsory primary education lasts for 9 years, and some parts of the country include compulsory preschool education in the year prior to Grade 1. Children typically enroll in primary school in the year they turn 6; they must be 6 years old by September 1 to begin school in September. High school enrollment does not depend on passing an entrance exam and varies across the cantons, entities, and Brčko District. In the cantons of Sarajevo and Tuzla, students take an external matriculation exam in the final grade of primary school, although this is not a deciding factor for high school admission. Some secondary schools, e.g., art schools, require students to pass an entrance exam showing outstanding skills. Secondary education is optional except in Sarajevo Canton, where the first 2 years are compulsory. There is no organized home education in BiH.

Secondary education (ISCED 3) is available in the form of general education (grammar school), vocational secondary education, arts education, and religious education. General secondary education, arts education, and religious education each last for 4 years, while vocational secondary education, delivered through technical or vocational secondary schools, lasts for 3 or 4 years. In Tuzla Canton, students in the final grade of grammar school and other high schools are required to take external matriculation exams.

At the tertiary level, Bosnia and Herzegovina, together with 48 European countries, has implemented a series of changes known as the Bologna Process, which has reformed the higher education system across Europe (with adjustments completed in 2010).[1] The goals of the Bologna Process have not yet been fully met in terms of the mobility of students, professors, scientific workers, and administrative workers in ensuring the employment of European citizens, international competitiveness of European education systems, and the creation of opportunities for learning and teaching. Creating an adequate space for education is the duty and responsibility of every European country, which, by signing the Bologna Declaration, may face numerous challenges and obstacles. In this sense, the education systems in Bosnia and Herzegovina are preparing action plans for consistency with European education initiatives.

Education is delivered in three official languages—Bosnian, Croatian, and Serbian—depending on education needs and population structure. Primary education is taught in the official languages of the constituent peoples of Bosnia and Herzegovina, in both official Cyrillic

and Latin scripts. There are also private primary and secondary schools that deliver classes in English, French, Turkish, and German.

In some primary schools, there is segregation of children, called "two schools under one roof," where Croatian and Bosnian children attend classes in the same building but use separate entrances and separate school and teaching programs. In some cantons, there are also examples of segregation.[2]

Education in BiH is mostly financed from the public funds of the entity, cantonal, Brčko District, and municipal budgets. Therefore, there are 13 budgets for education in BiH: two at the entity level, one in Brčko District, and 10 cantonal budgets.

Preschool Education (ISCED 0)

The right to preschool education has been declared a universal right according to international standards, including the United Nations Convention on the Rights of the Child. However, the lack of equal access to programs and institutions for early education affects the well-being of children in Bosnia and Herzegovina.

Preschool education (ISCED 0) is an integral part of the education system. It is regulated by the laws of the appropriate education authorities, which comply with the Framework Law on Preschool Education in Bosnia and Herzegovina (Official Gazette of Bosnia and Herzegovina No. 88/07).

Early childhood education and care (ECEC) is free and compulsory in FBiH and Brčko District from the age of 5, with up to 5 hours a week. Although not compulsory in Republika Srpska, the program is implemented free of charge. Children who have not previously attended a regular kindergarten program must enroll in a short preschool program (maximum 200 hours) in the year before going to primary school. A compulsory preschool education program can be organized in schools and preschool institutions. The goals of the program are aimed at realizing the full potential of each child and their communication and creativity through physical health, intellectual and socioemotional development, and development of speech.

Preschool education is delivered at three levels:

- nursery (ages 6 months to 3 years)
- kindergarten (ages 3 to 6 years)
- preschool preparatory program (150 to 180 hours in the year prior to starting Grade 1)

According to data from the Agency for Statistics of Bosnia and Herzegovina, the percentage of children ages 3 to 5 with preschool education in Bosnia and Herzegovina in 2022–2023 was 42% and 46% for children ages 5 and 6.[3] This is significantly lower than the European average yet significantly higher than previously reported. According to the EU 2020 Strategy, at least 95% of children between the ages of 4 and 6 should be included in preschool education. Consequently, the efforts of BiH education authorities to increase children's involvement in preschool education should be even greater.

Although preschool education in the year prior to starting primary education is compulsory according to the Framework Law on Preschool Education in Bosnia and Herzegovina, compliance varies across education authorities. Some have not yet adopted their own laws in line with the framework, mainly due to financial reasons. In FBiH—apart from Central Bosnia Canton, Herzegovina-Neretva Canton, West Herzegovina Canton, and Brčko District, which have not passed legislation in line with the framework law—preschool education in the year prior to starting primary education is compulsory for all children. In Republika Srpska, preschool education in the year prior to starting primary education is optional.

Primary Education (ISCED 1 and 2)

Under the current law, primary education (ISCED 1 and 2) is compulsory and free. However, in most schools, parents buy textbooks and other school supplies. Since 2020, in some cantons and in Republika Srpska, free textbooks are provided for the first four grades of primary school.[ab] In addition, there are local communities that budget for and provide free textbooks for students in 9-year education. The only criterion for enrollment in first grade is that the child must turn 6 by September 1 of the year of enrollment.[ac]

A major reform in primary education took place in 2004 when compulsory education was extended from 8 years to 9 years.

Curricular reform documents *Common Core Defined on Learning Outcomes* and *Guidelines for the Implementation of the Common Core Defined on Learning Outcomes* were presented to all education authorities in 2018.[4]

Curricular reforms have been in force since 2022 in Sarajevo Canton[ad] and Zenica-Doboj Canton[ae] and have started in Una-Sana Canton, Bosnia-Podrinje Canton Goražde, and Herzegovina-Neretva Canton.

During the reporting period (the period between TIMSS cycles), the entity of Republika Srpska improved the existing curriculum, applying the methodology based on learning outcomes and diverse methodological approaches to teaching. In addition, certain directives set out the teaching process toward individualization and differentiation so that each student, in accordance with his or her knowledge, skills, and competencies, has the opportunity to progress and succeed.

Secondary Education (ISCED 4)

Secondary education (ISCED 3/ISCED 4) is available in the form of general education (grammar school), vocational secondary education, arts education, and religious education.[af]

ab See https://savezsindikatars.org/wp-content/uploads/2022/08/zakon-o-osnovnom-obrazovanju-2022.pdf for more information.

ac See https://www.paragraf.ba/propisi/bih/okvirni-zakon-o-osnovnom-i-srednjem-obrazovanju-u-bosni-i-hercegovini.html for more information.

ad See https://kurikulum.ks.gov.ba/ for more information.

ae See https://kurikulumpzzdk.ba/ for more information.

af See https://aposo.gov.ba/sadrzaj/uploads/Law_of_Agency.pdf for more information.

Secondary education is provided in several types of secondary schools: vocational schools, technical schools, grammar schools, art schools, religious schools, and secondary schools for children with developmental disabilities. Students who graduate from a technical school, grammar school, art school, religious school, or school for children with developmental disabilities—each of which lasts 4 years—can enroll in a university or academy (higher education) by taking an entrance exam at a higher education institution. Vocational schools last 3 years and include a period of practical teaching. This type of school trains students for a specific profession. Students who complete this education path go directly to the labor market and have no access to university. Secondary education is not compulsory in most parts of Bosnia and Herzegovina.

Use and Impact of TIMSS

The document *Common Core Curricula Defined on Learning Outcomes* for mathematics and science is available to all education authorities in Bosnia and Herzegovina.[5] CCC for mathematics and science is informed by TIMSS topics and released TIMSS items from previous cycles. Upon the publication of TIMSS 2019 results for Bosnia and Herzegovina, most ministries of education have used the document to improve the curricula, focusing on learning outcomes rather than content, while some cantons started curricular reforms.[6] Each canton and entity, as well as Brčko District, can use specific curricula recommended and monitored by the appropriate ministry.

In 2007, TIMSS was administered to eighth-grade students, with analysis published in 2009.[7] The material was made public, but unfortunately, education authorities have not used the results to create education policies. There were exceptions among teachers/individuals, but there were no systemic changes in the progression of student achievements in mathematics based on TIMSS results.

TIMSS 2019 marked the first time fourth-grade students in Bosnia and Herzegovina participated in TIMSS, and they used paper and pencil. TIMSS 2023 was conducted digitally, which means the test participants filled out the questionnaires and test booklets electronically.

In 2020, *TIMSS 2019 Report for Bosnia and Herzegovina*, with results and recommendations for BiH,[8] was published. Through various dissemination methods, APOSO promoted the importance of TIMSS data to education authorities at all levels of education. In 2021, based on the TIMSS report, a series of meetings and online workshops were held with representatives of education authorities and institutions. In focus were the TIMSS 2019 results and factors influencing student achievement in mathematics and science. The TIMSS 2019 reports and results were sent to all competent education authorities with the aim of improving student achievement in mathematics and science, and education systems in general. Some administrative units used findings from the BiH reports about TIMSS 2019 in their curricular reforms, focusing to a lesser degree on factors that affect student achievement (e.g., school climate, learning how to learn, professional development of teachers, empathy).

Additionally, some administrative units, e.g., Sarajevo Canton, have begun teaching certain topics in mathematics and science that are included in *TIMSS 2019 Assessment Frameworks*. Namely, the Data and Probability domain has been integrated into the teaching process from the first grade of primary education. The curricular reform based on learning outcomes has contributed to more effective training of teachers and applying new methods of learning, monitoring, assessing, and evaluating student achievement.

There is a very positive example in West-Herzegovina Canton and its pedagogical institute. They took a very studious approach to the TIMSS 2019 report, resulting in the presentation of TIMSS 2019 results at meetings of primary and secondary school principals, as well as presentation and analysis of TIMSS 2019 results at teacher meetings aimed at implementing TIMSS education areas in the teaching process. In accordance with the responsibilities of the pedagogical institute and in cooperation with educational institutions, certain steps were defined and implemented in response to TIMSS survey results; for example, an initiative to reform the curricula and carry out external assessments of student achievement was launched in primary and secondary schools.[9]

Recommendations based on TIMSS 2019 results have contributed to the practice of formative monitoring using various techniques as a common teaching practice in many administrative units. In response to data about external factors affecting student achievement, special extracurricular programs have been introduced to prevent peer violence and initiate activities focused on entrepreneurial spirit and healthy lifestyles.

Based on the TIMSS 2019 results, educational institutions are planning internal studies of student achievements not only to measure the effects of the curricular reform, but also to see areas of strength and for improvement. Special attention will be paid to the development of metacognition and the competence of learning how to learn.

In addition, in-depth analyses of data collected by the International Association for the Evaluation of Educational Achievement (IEA) are available in electronic form and in regional languages. The regional report *Dinaric Perspectives on TIMSS 2019: Teaching and Learning Mathematics and Science in Southeastern Europe*, created in cooperation with institutions within the Dinaric region conducting the TIMSS survey, has been translated into regional languages to make it more accessible to interested educational organizations.[10] This open access book brings together national experts from across the Dinaric region to rigorously review IEA's TIMSS 2019 Grade 4 data to develop a multidimensional and culturally sensitive perspective on TIMSS 2019 primary-level results. The analyses and comparisons in the chapters "Students' Interests, Motivation and Self-Confidence" and "Characteristics of Low- and High-Performing Students" will be useful for education experts in the Dinaric region to understand similarities and differences in the region. The results also make it possible to reconsider education aspirations, connect practical experience to empirical data, and improve cooperation among educational organizations within the region.

Thus, TIMSS 2019 survey results have been and continue to be a road map and a source of data for many researchers in Bosnia and Herzegovina, and based on objective indicators, efforts

should be made to improve existing education systems. Based on TIMSS 2019 data, APOSO has prepared and published *Preschool Education as a Determinant of Student Achievement in Bosnia and Herzegovina in the TIMSS 2019 Survey,* as well as *The Impact of Homework on Student Achievement in Bosnia and Herzegovina in the TIMSS 2019 Survey*. APOSO also prepared *Analysis of TIMSS 2019 Items by Content and Cognitive Domains*.[11] These publications are publicly available and have been presented to the education authorities in Bosnia and Herzegovina.[12] Unfortunately, there is still no systematic support for international surveys in education in Bosnia and Herzegovina.

Overall, the results could be better used for systematically improving education systems in Bosnia and Herzegovina, especially in the areas of mathematics and science. However, aware of its role and competence, APOSO is still committed to surveying and analyzing obtained data to further examine the relationship between student achievement and factors that shape learning. In addition, APOSO is always at the disposal of competent ministries of education, pedagogical institutes, higher education institutions, and other interested parties for developing secondary/thematic analyses.

APOSO circulated a memo to all ministries of education referring to the development of secondary/thematic analyses based on the TIMSS 2019 results. APOSO organized an expert network conference and presented the *TIMSS 2019 Report for Bosnia and Herzegovina*, as well as the report's results and recommendations. A series of thematic network workshops related to the TIMSS 2019 results was organized, where the possibilities of secondary analyses were discussed. The third workshop was held on January 5, 2023, and it focused on the importance of preschool education and early learning for the academic success of students. *TIMSS 2019 Report for Bosnia and Herzegovina*, presentations, and working material can be found on APOSO's website.

In 2020–2021, APOSO defined the Student Achievement Standards in mathematics and science based on the TIMSS 2019 results and assessment topics.[13,14] In the process, a methodology of relating the CCC to the defined standards of student achievement was developed. The standards have been disseminated to all stakeholders and education authorities.

Furthermore, on the basis of TIMSS publications, the EU project Education for Employment paired experts who participated in the TIMSS survey and developed training for experienced mathematics teachers to practice developing items using TIMSS items as a guide. A segment of Education for Employment also addressed improving professional development for teachers, proposing a model that would contribute to continuous professional development (CPD). Used in the process were data from *TIMSS 2019 Report for Bosnia and Herzegovina* related to the impact of the school climate, professional development of teachers, training, preparation, and teaching methods. As a result, solutions for future development and a model were proposed that should contribute to improved CPD.[15]

The Mathematics Curriculum in Primary and Lower Secondary Grades

The mathematics curriculum is adapted by each ministry of education upon proposal of the pedagogical institute, in accordance with the CCC referred to in Articles 42 and 43 of the Framework Law on Primary and Secondary Education in Bosnia and Herzegovina (Official Gazette of Bosnia and Herzegovina, No. 18/03).[ag]

The CCC for mathematics comprises the following domains:

- sets, numbers, and operations
- algebra
- geometry and measurements
- data and probability

Exhibit 2 presents the mathematics curricula in different regions of Bosnia and Herzegovina.[ah]

Exhibit 2: Mathematics Curricula in Entities, Cantons, and Brčko District[ai]

Location	Language of Curriculum	Domains/Contents/Topics
Republika Srpska	Serbian	• geometric figures and their relationships: point, midpoint, line, plane • geometric figures/shapes: circle-angle • rectangle, square, triangle • natural numbers and operations • natural numbers up to 1,000 • adding and subtracting up to 1,000 • multiplying and dividing up to 1,000 • fractions • measurement and measures

ag See https://aposo.gov.ba/sadrzaj/uploads/Okvirni-zakon-o-osnovnom-i-srednjem-obrazovanju-u-Bosni-i-Hercegovini.pdf for more information.

ah See https://www.rpzrs.org/sajt/doc/file/Novi_nastavni_programi/Redovna_nastava/2021/Matematika_nastavni_programi_za_osmi_razred.pdf for information on the Grade 8 mathematics curriculum in Serbian for Republika Srpska. See https://mo.ks.gov.ba/sites/mo.ks.gov.ba/files/2021-02/5._matematika_0.pdf for information on the Grade 8 mathematics curriculum in Bosnian for Sarajevo Canton. See https://mozks-ksb.ba/wp-content/uploads/2019/11/Nastavni-plan-i-program-na-hrvatskome-jeziku-za-devetogodisnje-osnovne-skole-u-Bosni-i-Hercegovini.pdf for information on the Grade 8 mathematics curriculum in Croatian for 9-year primary schools in Bosnia and Herzegovina.

ai In the Brčko district administrative unit, curricula and programs in Bosnian, Croatian, and Serbian languages are implemented.

Exhibit 2: Mathematics Curricula in Entities, Cantons, and Brčko District (Continued)

Location	Language of Curriculum	Domains/Contents/Topics
Federation of Bosnia and Herzegovina Sarajevo Canton Tuzla Canton Una-Sana Canton Bosnian-Podrinje Canton Goražde Central Bosnia Canton Herzegovina-Neretva Canton	Bosnian	• numbers up to 1,000 • straight lines • adding and subtracting up to 1,000 • circle and circumference • multiplying and dividing up to 1,000 • numbers up to 10,000 • size measurement
Sarajevo Canton Zenica-Doboj Canton	Bosnian	Curricular reform • sets, numbers, and operations • algebra/numbers • geometry and measurements • data and probability
Herzegovina-Neretva Canton West Herzegovina Canton Posavina Canton Canton 10 Central Bosnia Canton	Croatian	• numbers up to 1,000 • a letter as a sign for the number • comparing numbers up to 1,000 • writing two-digit and three-digit numbers • adding and subtracting multiples of 100 • adding and subtracting three-digit and one-digit numbers • written addition of numbers up to 100 • written addition and subtraction of numbers up to 1,000 • the plane, the characters in the plane • direction, half direction, and length as parts of a direction • length measurement • multiplying the sum of numbers • multiplying and dividing numbers by 10 and 100 • geometry • liquid and mass measurement

The Science Curriculum in Primary and Lower Secondary Grades

The CCC for science comprises the following domains:

- Earth
- Structure and Functional Connection Between Living and Nonliving Nature
- Structure of Matter and Change in Energy
- Man as a Biological and Social Being

Exhibit 3 presents the science curricula in different regions of Bosnia and Herzegovina.[aj]

Exhibit 3: Science Curricula in Entities and Cantons, and Brčko District

Location	Language of Curriculum	Domains/Contents/Topics
Republika Srpska	Serbian	• spatial orientation and cartographic literacy • homeland and Republika Srpska • natural resources and human activities • living and nonliving nature • plants and animals • materials and movement • communication and media

aj For information on the science curriculum in Serbian for Republika Srpska, see https://www.rpz-rs.org/sajt/doc/file/Novi_nastavni_programi/Redovna_nastava/2023/8.%D1%80%D0%B0%D0%B7%D1%80%D0%B5%D0%B4_/%D0%BD%D0%BF_%D0%B7%D0%B0_%D0%B1%D0%B8%D0%BE%D0%BB%D0%BE%D0%B3%D0%B8%D1%98%_D1%83_%D0%B7%D0%B0_8_%D1%80%D0%B0%D0%B7%D1%80%D0%B5%D0%B4.pdf (biology), https://www.rpz-rs.org/sajt/doc/file/Novi_nastavni_programi/Redovna_nastava/2022/Fizika_nastavni_program_za_8_razred.pdf (physics), https://www.rpz-rs.org/sajt/doc/file/Novi_nastavni_programi/Redovna_nastava/2022/Hemija_nastavni_program_za_osmi_razred.pdf (chemistry), and https://www.rpz-rs.org/sajt/doc/file/Novi_nastavni_programi/Redovna_nastava/2022/Geografija_nastavni_program_za_8_razred.pdf (geography).
For information on the science curriculum in Bosnian for Sarajevo Canton, see https://mo.ks.gov.ba/sites/mo.ks.gov.ba/files/2021-02/12._biologija_0.pdf (biology), https://mo.ks.gov.ba/sites/mo.ks.gov.ba/files/2021-02/14._fizika_0.pdf (physics), https://ossbb.edu.ba/wp-content/uploads/2020/02/hemija-NPiP.pdf (chemistry), and https://mo.ks.gov.ba/sites/mo.ks.gov.ba/files/2021-02/11._geografija_0.pdf (geography).
See https://mozks-ksb.ba/wp-content/uploads/2019/11/Nastavni-plan-i-program-na-hrvatskome-jeziku-za-devetogodisnje-osnovne-skole-u-Bosni-i-Herzegovina.pdf for information on the Grade 8 science curriculum in Croatian.

Exhibit 3: Science Curricula in Entities and Cantons, and Brčko District (Continued)

Location	Language of Curriculum	Domains/Contents/Topics
Federation of Bosnia and Herzegovina Sarajevo Canton Tuzla Canton Una-Sana Canton Bosnian-Podrinje Canton Goražde Zenica-Doboj Canton Herzegovina-Neretva Canton	Bosnian	• nature and natural processes (variety of phenomena and processes in nature; characteristics of living beings in relation to the living environment; living beings in annual and weather changes; human activities related to the seasons: sunlight, water, and air as conditions of life; movement of air, wind, wind speed and direction, local winds; changing the properties of matter by heating; green plants, plant parts, the role of individual parts; man as a natural and social being; atmospheric precipitation)
Federation of Bosnia and Herzegovina Sarajevo Canton Tuzla Canton Una-Sana Canton Bosnian-Podrinje Canton Goražde Zenica-Doboj Canton Herzegovina-Neretva Canton	Bosnian	• time and space (the past, present, and future of the region; characteristics of the homeland; day and hour, measuring time with a clock; orientation on a geographical map, finding significant geographical features) • society (wider homeland: canton, natural features; traffic connections in the wider homeland: canton; development of the wider homeland: economy, tourism; mutual relationship between the economy and the characteristics of the homeland; natural geographical features of Bosnia and Herzegovina) • hygiene (clothes and footwear; rest and recreation as a hygienic need; disease agents: enemies of health; culture of life; soil, water, and air pollution)
Zenica-Doboj Canton	Bosnian	Curricular reform • individual and society • living and nonliving nature • time and space • energy and movement
Sarajevo Canton	Bosnian	Curricular reform • Earth-space of living • nature around us • science around us

Exhibit 3: Science Curricula in Entities and Cantons, and Brčko District (Continued)

Location	Language of Curriculum	Domains/Contents/Topics
Herzegovina-Neretva Canton West Herzegovina Canton Posavina Canton Canton 10 Central Bosnia Canton	Croatian	• sides of the world, standpoint and horizon • navigating the space • geographic map • the appearance of the homeland • homeland waters • the importance of water for people • an experiment • Adriatic Sea • homeland • economy and environmental protection • my county • time, time line • traffic • health • plant and animal life

Teacher Professional Development Requirements and Programs

Professional Development Requirements

By no later than June 30 of the academic year, each relevant education ministry, at the request of the pedagogical institute, provides a compulsory plan for implementing professional development programs in the following academic year. Educational institutions then develop a plan to implement professional development programs, based on the Council of Teachers or Council of Educators' expert team proposal. Each Ministry of Education decides on mandatory professional development programs for all education staff. The pedagogical institute then analyzes needs for professional development, plans, and organizes, as well as implements, finances, evaluates, and reports on professional development activities. In accordance with each entity or canton's Training Program and Catalog, the respective entity/canton funds continuous professional development (CPD) initiatives.

Every teacher is obliged to participate in CPD, according to the laws on primary education in Bosnia and Herzegovina. However, analyses indicate the programs are outdated, do not follow education trends, and actually do not enable professional development. Teachers lack adequate education and support in developing professional competencies. CPD is decentralized in Bosnia and Herzegovina and there is no consistent approach to it. Therefore, this area needs to be revisited with new rules for professional development and the promotion of educators, teachers, and professional associates in educational institutions in accordance with the law. Regulations should also contain indicators for the evaluation of CPD, with specific conditions and procedures for acquiring teaching titles.

Although the system of professional development of teachers has improved considerably in some administrative units, there is still no adequate professional development or professional licensing system in Bosnia and Herzegovina. In most administrative units, there are no professional development requirements for fourth-grade teachers of mathematics and science.

Ongoing Professional Development Programs

CPD is carried out through training, improvement, and evaluation programs. CPD of teachers, organized by pedagogical institutes, is funded by cantonal budgets and by budgets of Republika Srpska Government and Brčko District Government, so the amount and distribution of funds vary significantly.

CPD of teachers is evaluated through participation in professional training established by the relevant Ministry of Education, participation in professional training conducted by professional institutions and associations, and studying professional literature and magazines. Professional development is evaluated on both a regular and occasional basis. Only teachers who regularly attend CPD programs can advance to the positions of mentors and advisors, yet advancement systems differ across administrative units.

In addition, within the EU's Erasmus+ program, Bosnia and Herzegovina has the opportunity to participate in the European School Education Platform/eTwinning. The platform is intended to support teaching and nonteaching staff of educational institutions through the exchange of professional experience and the improvement of language and information technology skills. It also offers cross-curricular topics for CPD of mathematics and science teachers. By participating in the projects, teachers share ideas and acquire new knowledge about motivating students, with different methods of creativity and innovation in project teaching, to actively participate in the teaching process and acquire functional knowledge for further activities, subsequent levels of education, and everyday life situations.[ak]

In Sarajevo Canton, there is a need for CPD of teachers in the mathematical domain Data and Probability. Sarajevo Canton has a CPD catalog offering professional development opportunities on topics related to mathematics and science subject areas.

In most other administrative units, new programs for CPD in mathematics and science of fourth-grade teachers have not yet been developed.

Monitoring Student Progress in Mathematics and Science

Monitoring of student progress in mathematics and science is defined by regulations on monitoring, evaluation, and assessment of students.[al] In Bosnia and Herzegovina, there is no external evaluation either at the State level or at the administrative unit level. The process of monitoring, evaluation, and assessment is realized at the level of students as individuals and at

ak See https://school-education.ec.europa.eu/en/etwinning for more information.

al See the Rulebook on Monitoring, Evaluating and Assessing the Primary and Secondary School Students of Sarajevo Canton (2018) (https://savezsindikatars.org/wp-content/uploads/2022/08/zakon-o-osnovnom-obrazovanju-2022.pdf) for an example.

the level of the class. In general, the mathematics and science teacher in the fourth-grade class performs the process. Advisors at the ministries of education give teachers the opportunity to actively learn and apply new knowledge, methods, and competencies to improve classroom teaching in general.

The evaluation of student knowledge implies systematic collection of data in the learning process on the achieved level of students' competencies in the following:

- knowledge
- skills
- abilities
- independence and responsibility for work
- set tasks
- education values

In evaluating students with disabilities who master individually tailored programs, teachers should adapt the method and procedure to their capabilities and condition.

Checking students' knowledge involves assessing the level of knowledge and achievement in mathematics and science through oral answers (presentations, reports, answers to questions, experiments, and project- and problem-based teaching) and in writing (tests, control tasks, and homework).

Student evaluation is a continuous process by which the teacher, based on a broader and complex knowledge of the student, evaluates the qualitative and quantitative side of each student's work and efforts, according to established regulations; that is, the teacher monitors the educational development of the student and assesses the education level and progress of the student. The grade given to a student should be objective and represent a reliable measure of student progress and development and efficiency in achieving prescribed goals and outcomes, and an incentive for student development.

Descriptive grades express

- achievement of goals and learning outcomes in mastering the curriculum,
- engagement of student in classes,
- progress compared to the previous period, and
- recommendation for further progress of student and student behavior.

Descriptive grades are as follows:

- extremely successful
- successful
- participates

Numeric school grades express the degree of achievement of goals and learning outcomes in mastering the curriculum contents, student engagement in class, and student behavior. Numeric school grades are as follows:

1. insufficient
2. sufficient
3. good
4. very good
5. excellent

The criteria for numeric evaluation of students are included in some regulations. Engagement of students implies

- responsibility for work,
- responsibility for assigned tasks,
- active participation in classes,
- cooperation with others, and
- expressed interest and motivation.

Special Initiatives in Mathematics and Science Education

Special initiatives in mathematics and science teaching focus on science, technology, engineering, and mathematics (STEM), while science and fine arts teaching use a cross-curricular approach to incorporate STEM. Initiatives for gifted students focus on their earlier completion of education and support for their participation in international competitions, innovation fairs, and other programs.[16] As for gender differences, it is necessary to foster support for female students in STEM and overcome preconceptions that certain professions are intended only for boys or girls. In some regions where there are fewer students, there are more classes with male and female students together in the lower grades in primary school.

According to the Law on Primary Education in Republika Srpska, Article 48, schools are responsible for identifying talented students; organizing their education, monitoring, and encouraging them; and providing additional teaching according to their preferences, abilities, and interests.[am] The minister of education approves the curriculum for talented students and a rulebook that establishes criteria for selecting them. However, there is no evidence the article is fully respected and that programs for talented students are implemented. Some initiatives for highly talented students include extra preparations for their participation in municipal, regional, and State competitions. These preparations are not realized through the regular teaching process but take place through teachers' additional efforts to adapt the curriculum to the talented students' needs.

To support talented students in mathematics, the Council of Math Teachers in Sarajevo Canton has initiated the publication of a collection of math tasks used previously in primary school math competitions. The publication will support the teaching of talented students to prepare them for math competitions. Also, the Ministry of Education, Science and Youth of

am See https://aposo.gov.ba/sadrzaj/uploads/Zakon-o-Agenciji.pdf for more information.

Sarajevo Canton supported an initiative of the II Gymnasium in Sarajevo to organize additional work for talented students in mathematics. Teachers held extra mathematics classes on Saturdays for talented students from primary and high schools. These students later achieved remarkable results at competitions. The Ministry also supported the work of associations that organized classes for talented students.

Initiatives regarding gender and socioeconomic differences are not systematically regulated across the education sector in entities, cantons, or Brčko District.

All over Bosnia and Herzegovina, there are initiatives to support both gifted and struggling students. The initiatives are related to student sections and additional teaching in these subjects. In order to popularize mathematics in Bosnia and Herzegovina and adequately work with gifted primary and secondary school students, students participate in numerous projects and competitions. Since the content in national and international competitions is not fully covered by regular school material and since new opportunities to apply for mathematics competitions arise almost every day, these methods will ensure adequate and continuous preparation of students throughout the year for upcoming domestic and international competitions, and for monitoring of modern mathematical trends. The popularization of mathematics should ultimately lead to increased student interest in enrolling the faculties that require solid mathematical knowledge and thus should increase the global competitiveness of Bosnia and Herzegovina in the European area of higher education and research. However, these initiatives differ across cantons, entities, and Brčko District and they are still not systemically supported. They are mostly dependent on individual character and based on the personal commitment of students, their parents, and individual teachers. With the launch of "extracurricular activities in the form of schools for mathematics and science," interested students would be given equal opportunities to improve their mathematical skills and further advancement.[17]

Based on TIMSS 2019 data, there are differences between boys and girls in average achievements in mathematics and science. For mathematics students in Bosnia and Herzegovina, boys scored 9 points higher than girls. In science, girls scored 7 points higher than boys. The international average for mathematics is 499 points for girls and 503 points for boys; in science, the international average is 493 points for girls and 489 points for boys. Average results by gender according to cognitive domains indicate that girls achieve better results in the domains of Applying and Reasoning.

In Bosnia and Herzegovina, students in urban schools scored 12 points higher in mathematics and science than students in rural schools.

TIMSS 2019 includes a scale that measures students' home resources for learning.[an] Students were divided into three categories so that resource-rich students were assigned 11.8 points, which corresponded to statements that they had more than 100 books at home, an Internet connection, and their own room, and that their parents reported having more than 25

an For more information, see *TIMSS 2019 International Results in Mathematics and Science* (https://timss2019.org/reports/home-contexts/index.html#contexts-home-contexts).

children's books at home; at least one parent has completed university education; and at least one parent has a profession such as scientist, mathematician, architect, engineer, teacher, etc. The level of parents' education can be considered a significant factor of student achievement in mathematics. Children whose parents have a higher level of education also score higher in mathematics. The same trend applies to science. Students who have more resources at home tend to have higher achievement in mathematics and science than students with fewer resources at home.

Suggested Reading

Đapo, N., Čelebičić, I., Spahić, L., & Binder-Hathaway, R. (2020). *Rodni jaz u STEM području i prijedlog intervencijskih programa* [The gender gap in the STEM field and a proposal for intervention programs], UN Women, https://promente.org/images/files/Gender_Gap_in_STEM_BiH_BHS.pdf

Jurić, J., & Pjanić, K. (2023). An overview of mental calculation strategies and the frequency of their application. *Journal of Elementary Education*, *16*(3), 277–294.

Nesimović, S., Alihodžić, B., & Džumhur, Ž. (2023). *Matematika u korelaciji sadrugim nastavnim temama (osnovna škola)* [Mathematics in correlation with other teaching topics (primary school)]. Pedagoški fakultet Univerzitet u Sarajevu [Faculty of Education, University of Sarajevo].

References

1 Agency for Development of Higher Education and Quality Assurance of Bosnia and Herzegovina. (n.d.). *Framework Law on Higher Education in Bosnia and Herzegovina*. Retrieved from https://hea.gov.ba/Content/Read/zakoni

2 Organization for Security and Co-operation in Europe (OSCE). (2018). *"Two schools under one roof": The most visible example of discrimination in education in Bosnia and Herzegovina*. https://www.osce.org/files/f/documents/3/8/404990.pdf

3 Agency for Statistics of Bosnia and Herzegovina. (2023). *Preschool upbringing and education in the school year 2022/2023*. https://bhas.gov.ba/data/Publikacije/Saopstenja/2023/EDU_07_2022_Y2_1_BS.pdf

4 Agency for Preprimary, Primary and Secondary Education. (2018). *Common core defined on learning outcomes*. Retrieved from https://aposo.gov.ba/bs/publikacije/zajednicka-jezgra-npp/

5 Agency for Preprimary, Primary and Secondary Education. (2018). *Common core curricula defined on learning outcomes in Bosnia and Herzegovina*. Retrieved from https://aposo.gov.ba/bs/publikacije/zajednicka-jezgra-npp/

6 Agency for Preprimary, Primary and Secondary Education. (2015). *Guidelines for the implementation of the common core curricula - general education*. Retrieved from https://aposo.gov.ba/bs/smjernice-za-provedbu-zjnpp/

7 Suzić, N. I., Saničanin, Ž., Alić, A., Skelić, D., Rukavina, D., Goro, E. A., Džumhur, Ž., Batista, S. Š., Rosić, I. M., Mešić, V., & Ibraković, A. (2009). *Secondary analysis of TIMSS 2007 in Bosnia and Herzegovina*. Agency for Preprimary, Primary and Secondary Education. https://aposo.gov.ba/sadrzaj/uploads/Sekundarna-analiza-TIMSS.pdf

[8] Džumhur, Ž. (2020). *TIMSS 2019 - report for Bosnia and Herzegovina*. Agency for Preprimary, Primary and Secondary Education. Retrieved from https://aposo.gov.ba/bs/timss-izvjestaj-za-bosnu-i-hercegovinu/

[9] Gudeljić, A. (2023). *Information submitted for the preparation of the TIMSS encyclopedia.* Ministry of Education, Science, Culture and Sports of Herzegovina-Neretva Canton, Mostar.

[10] Japelj-Pavešič, B., Koršňáková, P., & Meinck, S. (Eds.). (2022). *Dinaric perspectives on TIMSS 2019: Teaching and learning mathematics and science in south-eastern Europe*. Springer. https://aposo.gov.ba/sadrzaj/uploads/TIMSS-2019-Regionalni-izvjestaj.pdf

[11] Džumhur, Ž., Popić, B., & Kokoruš, N. (2022). *ANALIZA ZADATAKA po sadržajnim i kognitivnim domenama TIMSS 2019* [ANALYSIS of TIMSS 2019 items by content and cognitive domains]. Agency for Preprimary, Primary and Secondary Education. https://aposo.gov.ba/sadrzaj/uploads/%D0%90naliza-zadataka-po-sadrzajmim-i-kognitivnim-domenama-TIMSS.pdf

[12] Džumhur, Ž., Hasanagić, A., & Popić, B. (2022). *Značaj međunarodnih istraživanja u obrazovanju u unapređenju akademskih postignuća učenika preduniverzitetskog obrazovanja* [The importance of international surveys in education in improving the academic achievements of students in preuniversity education]. Agency for Preprimary, Primary and Secondary Education. https://aposo.gov.ba/sadrzaj/uploads/ZBORNIK-RADOVA-1.-dio.pdf

[13] Agency for Preprimary, Primary and Secondary Education. (2020). *Student achievement standards for mathematics*. https://aposo.gov.ba/sadrzaj/uploads/Matematika-BOS-s-napomenom.pdf

[14] Agency for Preprimary, Primary and Secondary Education. (2021). *Standards of student achievement*. https://aposo.gov.ba/bs/standardi-ucenickih-postignuca-bs/

[15] Working group for the professional development of teachers in the EU project Education for Employment. (2022). *Proposal of the model for continuous professional development of teachers, Sarajevo*. Retrieved from https://eu4education.ba/

[16] Pedagogical Institute of Republika Srpska. (n.d.). *Organization and implementation of competitions and support for gifted students*.

[17] Association of Mathematicians of Sarajevo Canton. (n.d.). *Mathematics school for working with gifted students*. Retrieved from http://umks.pmf.unsa.ba/skola-matematike-i-programiranja/svrha-i-ciljevi-projekta/