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## Consolidation of Science Education in Ethnically Divided Postwar Bosnia and Herzegovina

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**Abstract:** Because of war and civil war on the territory of Bosnia and Herzegovina, education in ethnically divided country has become fragmented. Because of postwar divisions thirteen different ministries of education or similar bodies are responsible for education, resulting in inefficiency and low quality. To overcome differences, a committee of experts has prepared an outcome-based common core curriculum for science education from preschool to the upper secondary school level. Since the working group comprised representatives from all major entities, ethnic and religious groups, and school levels, as well as teachers from Biology, Chemistry, Geography and Physics, a positive outcome for the consolidation of science education can be expected.

**Keywords:** *Consolidation, science education, Bosnia and Herzegovina*

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### Introduction

The Republic of Bosnia and Herzegovina (BiH) is a Southeastern European country situated in the Balkan Peninsula. It is a multi-ethnic state, with three main ethnic groups: 48% consider themselves Bosniaks, 37.1% Serbs, and 14.3% Croats. Considering religion, 40% of the population declare themselves Muslim, 31% Orthodox Christian and 15% Roman Catholic [1]. Between 1992 and 1995, there was a war on the territory of BiH between the neighboring countries of Serbia and Montenegro, the Republic of Bosnia and Herzegovina and Croatia, as well as civil war between the Bosniaks, Serbs and Croats. During the war almost 100 000 people died not only in combat but also in ethnic clearings (e. g. Srebrenica), and about 2 million were displaced. The war ended after NATO intervention and the Dayton agreement of 1995.

Before the war and the 1991 declaration of independence the Socialist Republic of Bosnia and Herzegovina was one of the six republics of the Socialist Federal Republic of Yugoslavia (1945 – 1991), and local self-government for the whole territory was provided at the municipal level. After the Dayton agreement, the once-united republic and independent member state of the UN from 1992 was divided into two entities: the more centralized Republika Srpska (49% of territory) and the Federation of Bosnia and Herzegovina (51% of territory), divided into ten cantons and the independent district of Brčko. At the third level, whole territory was

divided among a number of municipalities. This division, based mostly on ethnic grounds, is nowadays the source of many problems and of inefficiency, which renders Bosnia and Herzegovina a fragile country, governed by “those having a limited capacity and/or political will to provide basic services to the population” [2].

### Sources of Fragility in Education

In former Yugoslavia's educational system, only the institutional framework was common across all republics, but the content and language of teaching were left to the individual republics, a situation which was guaranteed by the constitution. The educational backbone comprised 8 years of elementary school at primary and lower secondary levels (ISCED 1 and 2) which was obligatory for 7 – 15-year old students. Completion of elementary school allowed entrance to a 4-year general Gimnazija programme (upper secondary school) or a number of 2 to 4-year professional and vocational programmes (ISCED 3A, 3B and 3c), and eventually to higher education afterwards. The outcome of such a system was that each republic created its own curriculum, published its own textbooks and had at least one institution to provide a supply of elementary and subject teachers for each school subject. Based on the constitution, the major languages of instruction were Macedonian, Serbo-Croatian and Slovenian. In some parts of Yugoslavia, the languages of the constitutional non-slavic minorities were also used (Albanian, Hungarian and Italian). For historical reasons, two

different scripts were used: the Cyrillic alphabet in Serbia, Montenegro and Macedonia, the Latin alphabet (with some differences between a number of letters) in Slovenia and Croatia, and both in Bosnia and Herzegovina and Kosovo. In the early eighties, there was a centralistic attempt to establish a common core content in education for all of Yugoslavia, with the leading idea that educational content - especially in history, geography and literary history - should be aligned with the percentage of the republics' territories and the size of national populations. The idea was opposed by intellectuals in some republics (especially Slovenia) and never came into effect.

Following the war on the territory of Bosnia and Herzegovina great changes, took place in the educational system, mostly based on nationalistic grounds. As an example, Serbo-Croatian, once treated as one language, split into three distinct languages: Bosnian, Croatian and Serbian. In accordance of the Dayton agreement, the educational system was decentralized. The argument that every child has the right to receive instruction in its mother tongue was used as a political excuse to break up the school system. As a result, not only the two entities but each canton and in some cases even community had formed its own ministry or similar body of education responsible for study programmes, syllabi and subject content. In total this makes 13 Ministries of Education on the territory of BiH with about 3.9 millions of inhabitants: ten cantonal ministries; Ministry of Science and Education of the Federation Bosnia and Herzegovina; Ministry of Education of Republika Srpska; Ministry of Education of District Brčko. The ministries only support elementary schools, while support for secondary schools is left to municipalities. Education thus become opaque because each educational entity produces its own educational system, feeding mostly on small differences. In extreme cases, in some cantons with ethnically mixed populations, as a legacy of these divisions there are nowadays in some municipalities two schools under the same roof, separated at ethnicity, each providing education by different curricula, using different syllabi and textbooks for similar subjects, and even forbidding teachers of a different nationality to teach in the "wrong" classroom. In addition, each ethnicity establishes its own parallel system for teacher education at a number of local Universities and Faculties. As a side effect the quality of education has suffered, yet internationally recognized comparisons are unavailable. The only reliable data are from the TIMSS 2007 Study, where their 8<sup>th</sup>- and 9<sup>th</sup>- graders' in achievements in mathematics and science were well below the group average [3].

### Attempts at Bridging the Gap

At some point practical considerations brought a recognition that such diversity in education does not

produce quality and that some common core in education has to be established. As a turning point, decision was made that elementary school should change from 8 to 9 years, and that 70% of the content should be a common core at the state level, while 30% was left to the school's discretion. While the transition to 9-year schooling is now finished, transition to this 70:30 scheme is only beginning. As an illustration, owing to poor coordination and the lack of will, the transition to 9-year schooling was not introduced simultaneously at the level of the state but followed different schedules, and was accompanied by occasionally irrational obstacles. The agreement at the state level that all elementary schools would change their curricula from 8 years to 9 years was signed in 2003. The introduction of these changes to different parts of the state took almost 10 years. The first entity introduced 9-year schooling by the 2004/05 school year, and the last two cantons by the 2012/13 school year. The differences were not only in pace, but also in different models being used. One encouraging example, demonstrating the will to bring some order to education, is the establishment of the Agency for Pre-Primary, Primary and Secondary Education (APOS0) [5] in 2009 (on the basis of the 2007 Act) as an independent administrative organization, with its seat in Mostar and two administration units, one in Sarajevo and one in Banja Luka. The agency's mission is defined as a) establishment of standards and standards of assessment in pre-school, elementary and secondary school education, and b) development of a common core for syllabi and programmes. Based on its mission, the Agency started by developing an outcome-based common core for science in 2013, following development of an outcome-based common core for languages and the planned development of a common core for social sciences, mathematics, informatics and technology education. The process of developing a common core is by no means simple because all Ministries must approve every major step, which means unnecessary delays in a process accompanied by lack of funding. After preparation of the initial document(s) by experts designated by each Ministry, they must pass public debate and be approved by the Ministries again to be passed on to local Boards of Education, which are responsible for transferring the common core into syllabi. Such an introduction can last for years, but the good news is, that common ground for debate has been established.

### Development of an Outcome-Based Common Core in Science

Preparation of the outcome-based common core in science started with an initial meeting (following the activities of APOS0 to assure funds) at the Agency in Mostar in September 2013. At this meeting, outlines for future work were prepared with cooperation among APOS0, a number of elected representatives from different regions and institutions in BiH and a visiting

expert from Slovenia. Work continued in the form of three-day seminars with a great deal of “homework” in between. The working group was diverse in several ways, and each participant was simultaneously representative of several different groups from the region. The working group included representatives from APOSO, both entities and all the cantons, of the three major nationalities, all three major religions, from pre-school, basic, elementary, and secondary schools, and boards of education, and, last but not least, teachers of Biology, Chemistry, Geography, Physics and Science both at basic and elementary levels. Altogether, about 40 persons were involved in the work on preparation of standards.

### Structure of the Outcome-Based Common Core for Science Education

The key idea was that the common core should be prepared outside the common subject divide to provide cross-curricular and inter- and intra-subject connectivity and consistency. The innovation in comparison with the old syllabi was that the common core was prepared as a list of outcomes, and not as goals and objectives, which is the case in the existing documents. Each outcome is followed by well-defined indicators for different age levels, with benchmarks set at the end of pre-school education (age-5-6); after the first 3 years (age 8-9); after 6 years (age 11-12), at the end of elementary school (age 14-15), and at the end of 4-year general secondary school (age 18-19).

The four content domains were as follows: 1) Earth, place of life; 2) Structure and functional connections between living beings and the non-living environment; 3) Structure of matter and energy conversion; 4) Humans – biological and societal beings. Each domain is further organized into four components, each covering different aspects and cognitive levels of teaching. Within these components are embedded competences defined for the purpose of the document according to EU framework of lifelong learning [5] as “a combination of knowledge, skills and attitudes appropriate to the context”. For scientific literacy, the OECD definition [6] was used, as “the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity”. Skills are understood as “the ability to do something that comes from training, experience, or practice” [7]. Typical examples of such skills are critical thinking and problem solving. Each component is structured into three to five learning outcomes. Outcomes in the document are written as statements with three characteristics: the activities must be student-oriented, observable and open to assessment.

The first component of each domain consists of outcomes in terms of factual, procedural and conceptual knowledge, following Bloom’s revised taxonomy [8]. The second component consists of outcomes, best described as practical work and experimentation, with the intention of developing procedural knowledge and skills. The third component comprises outcomes that contribute to the development of environmental literacy and positive attitudes towards science and society. The fourth component comprises outcomes that aim to develop communication and language skills.

### Conclusion

At this point, the common core curriculum for science education has passed public debate among teachers in all entities and cantons (more than 300 participants) and is on the way to being approved by the ministries and translated into all three official languages to be available to teachers and regional Boards of Education for translation into syllabi. The bad news is that complicated approval process could make this into a long-term process. The good news is that a sense of cooperation and the will to find solutions for science education were clearly expressed by all the participants regardless of their varied origin and backgrounds and that there was no opposition to the proposed common core among teachers in region.

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