



Comparing the education systems of Central-Eastern European countries – policies and curricula

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Abstract

My study compares education systems in the East-Central European region from the aspect of regulation and curriculum. Curriculum regulation is one of the main tools of education management. Each country has its own legislation in public education, having centrally developed curricula or standards. In my research, I am looking for the common features of these countries (Hungary, Romania, Serbia, Croatia, Slovenia, Austria, Slovakia, Czech Republic, Poland), which unify the region and assume similar functioning. My main question is: can we talk about unity in the regulation of education and curricula?

I compared these countries via the following aspects: Types of regulation and curriculum; Content of mathematics curricula; Evaluation system and exams. My research is based on document analysis. I rely on primary sources (educational laws, national curricula, regulations) and secondary sources (country reports, OECD publications).

In my comparison, I identified the consistent aspects of the region, such as the strong central regulation through legislation, although the implementation of the laws is at a lower level leading to a different centralization in enforcement and control. Moreover, each country has a national core curriculum and local/school curricula providing the freedom of institutions, but its scale is different. In the second part of my study, I compare the mathematics curricula of the countries, since that subject is part of the international assessments (PISA, TIMSS). I point out the differences that may cause different results in international studies; the number of math lessons in primary school (Austria has 150 hours of mathematics a year, Hungary has only 81, and other countries have around 105 hours), and the different contents of 8th grade mathematics education (for example, in Romania, the topic of probability calculation does not appear in this grade).

The results of my research help to illustrate the functioning and differences of the educational systems of the region and point out what makes them still unified, even though they have progressed in different ways.

1. Introduction

I have decided to apply a specific set of criteria in the designation of what this paper means by the Central-Eastern European region. I have considered it essential for the countries selected to be neighboring Hungary or be in close proximity. Other criteria were membership in the European Union and participation in international education attainment surveys, as well as having a similar historical, political and economic background as Hungary. Based on these, the countries examined in the present paper are Hungary, Romania, Serbia, Croatia, Slovenia, Austria, Slovakia, Czech Republic, and Poland (Barber & Mourshed, 2007; Jakubowski, 2015; Kelemen, 2010; Kozma, 2006; Lannert, 2004; Valuch, 2009).

My paper is a comparative study based on the analysis of documents, examining the differences and similarities in the education systems of the area under scrutiny. The specific question the paper seeks to answer is the assumed presence of common elements in these systems that unify the region and presuppose some sort of a similar mechanism. In academic literature on the subject, it is commonplace to say that the CEE region is can be differentiated from the rest of Europe based on its common past and similar development, but can we speak of unity when it comes to education directives and curricula?

Former studies have concerned themselves with the analysis of a given country's education system (Barber, & Mourshed, 2007; Báthory, 2000; Birzea, 1994, 1995; Cankaya, Kutlu, & Cebeci, 2015; Creese, Gonzalez, & Isaacs, 2016; Dolence, 2003; Horváth & Környei, 2003; Leung, 1992; Réti, 2015; Smith, 2000; Tajalli & Polzer, 2004; Tomiak, 1995), but a study on this scale, examining the whole region based on my specific set of criteria has never been conducted before, which is why it is important to carry it out in order to gain a better understanding of the region's education systems. My purpose was to comparatively examine the current documents, regulations and system structures pertaining to elementary schools. After a general review, I have narrowed down the scope of the examination to 8th graders, because the 14-15-year-old pupils already participate in international surveys, which provides an opportunity to compare their educational attainment, as well. Further analysis is concerned with the subject of Mathematics, which is also subject to international surveys (PISA, TIMSS).

Historical connections

Countries of the region in question have been affected in various ways throughout history, and the influence of the Austro-Hungarian Empire, Russia and the Baltic states is also apparent. Politics, institutions and ideas were different in each country, but the region can be regarded as an entity in certain aspects. In my study I arrange these countries into three groups to depict these intertwinings. My analysis starts from the mid 1800's and lasts until the EU accession.

There are several similarities in the histories of Hungary and its western and eastern neighbors. After the revolution and war of independence in 1848-49, Hungary followed the politics of Vienna. One of the main aims of the Habsburg Empire was the restoration of unity and centralization, which meant the end of Hungary's relative independence and the introduction of German-speaking administration (Jelavich, 1987; Horváth, 1993; Csihák, 2002; Evans, 2006; Balog, 2008). The country's name was changed to Austro-Hungarian Empire in 1867 which gained Hungary a great deal of autonomy. In Romania education legislation introduced compulsory and free elementary education before the Compromise, and before 1900 public education was established in its present form.

The powers of the state and church were separated in Austria in 1868, and compulsory schooling regardless of gender was introduced according to the imperial school law or Reichsvolksschulgesetz in 1869. The Austro-Hungarian Empire collapsed in 1918, and the intention to completely restructure the Hungarian education policy and curriculum was announced afterwards. The compulsory school age was raised to 14, and in Austrian primary schools, a new curriculum and new textbooks were introduced (Bundesministerium für Bildung, 2016). In 1919, the Hungarian Soviet Republic was formed following the Soviet model which stayed in power for almost six months and declared a complete separation of state and church. Under the Trianon Peace Treaty, the Kingdom of Hungary lost almost two-thirds of its territory and one-third of the Hungarian population was annexed by the surrounding countries. In 1945, the first independent republic of Austria was proclaimed (Jelavich, 1987; Zsirosné, 2002; Vocelka, 2006; Evans, 2006; Rathkolb, 2010). Meanwhile in Hungary, several years of multi-party parliamentary democracy were followed by a one-party communist regime based on the Soviet model. During the years between 1938 and 1945 in Austria, under the nazi regime sexes in education were strictly segregated (Uni Wien Geschichte Online, é.n.; Bundesministerium für Bildung, 2016).

In Hungary, the system of folk schools and grammar schools was reorganized on the basis of the biggest school structure reform of the 20th century. Only the principle of a state-run "united school, united education" was accepted which sought to introduce a Soviet-style radical school reform (Horváth, 1993; Zsirosné, 2002). In 1961, the Hungarian parliament decided to implement compulsory education until the age of 16. The comprehensive education legislation introduced in Austria in 1962 extended compulsory schooling to nine years and made education free of charge in all public schools (Bundesministerium für Bildung, 2016). As the most important act of the 1989 Regime Change, the Hungarian Republic was proclaimed (Balog, 2008; Csihák, 2002; Gyarmati, 2012).

Public education in Romania was one of the most centralized of the countries, but attempts for decentralization appeared during the reforms. Before the reforms of 1993, Romania's education was strict and outdated, but over time improvements reached the whole country (Ministry of Education and Research, 2001). In 1995 Austria, in 2004

Hungary and in 2007 Romania joined the EU (European Union, 2017).

Slovakia – Czech Republic – Poland

Heading north from Hungary, I examined the territories of Slovakia, the Czech Republic and Poland. Not only is the history of the three countries intertwined, but they are also in close connection with Hungary, Austria and Romania. Slovakia, the Czech Republic and Poland also have a continental-type education system with cultural and historical roots similar to the Hungarian. This system is largely determined by the Soviet model (Jakubowski, 2015). The democratic Czechoslovak Republic was formed in 1918, in the same year after 123 years of fragmentation, an independent Poland was re-established in the form of a republic.

In Poland, the first education reform was introduced in 1934. Czechoslovakia, a successor state of the Austro-Hungarian Empire, had a well-developed industry, but turmoils concerning questions on nationality caused some troubles in its domestic and foreign policy. To prevent these nationalistic upheavals, the Czechoslovak-Romanian-Yugoslav Alliance was formed in 1921 and operated until 1938 (Kováč, 2001; Heimann, 2009; Bencsik, 2016; Oktatási Hivatal, 2014; Jakubowski, 2015). During WWII, Czechoslovakia ceased to exist, it was under German occupation until 1944. In 1944, the provisional Czechoslovak government was created and the country regained the territories it had prior to the 1938 agreements. In 1944, the Slovak National Council issued a decree on the nationalization of education, so all educational institutions in the country became state-owned.

The Republic of Poland was established and operated from 1945 to 1989. In 1948 in Poland, the duration of elementary school education was increased to seven, followed by four years of secondary school education (Velkey, 2015; Davies, 2006; Mitrovits, 2009). In 1948, the Czechoslovak Republic was transformed into the Czechoslovak Socialist Republic, and it adopted a policy of Soviet-type socialism. The Czechoslovak Education Act of 1948 stated that education should be conducted in the state language but guaranteed the rights of minorities living in the country (Kováč, 2001; Davies, 2006; Mitrovits, 2009; Oktatási Hivatal, 2014). From 1950 to 1989, Czechoslovakia's education was characterized by strong centralization. The Education Act of 1984, passed by the Czechoslovak Parliament, specified that compulsory education should be 10 years. The Slovak education system has nine grades in elementary schools (4+5), compulsory education is 10 years (Szűcs, 2014). At the end of December 1989, Czechoslovakia became a democratic republic. In 1990, the Constitutional Law on Primary and Secondary Education was amended and the compulsory education was reduced from ten to nine years. This education legislation launched a decentralization process and introduced normative financing of primary and secondary schools (Lannert, 1998). On the 1st of January 1993, Czechoslovakia dissolved into two separate and independent states, the Czech Republic and the Slovak Republic (Kováč, 2001; Szűcs, 2014; Davies, 2006; Mitrovits, 2009). Slovakia, the Czech Republic and Poland joined the EU in 2004 (European Union, 2017).

Serbia – Croatia– Slovenia

Concerning the southern and southwestern countries, northern Serbia, Croatia and Slovenia were also part of the Habsburg Empire. For a while, Serbia's territory had been divided, one part belonged to the Habsburg Empire and the other was under Turkish influence (Bíró, Rész, & Sokcsévits, 2011; Harmat, 2015). The country's policy was increasingly determined by Russian influence, which led to the formation of the Balkan Alliance (Jelavich, 1996; Du Nay, 2006; Isaszegi, 2012). In 1918, the Kingdom of Serbia-Croatia-Slovenia was proclaimed, in 1929 it was renamed the Kingdom of Yugoslavia. In the newly formed state there were large differences concerning elementary education, it had five different education legislations at the same time. In 1919, the compulsory education was 4 years in Serbia, 5 in Croatia, 6 in Vojvodina and 8 in Slovenia (Székely, 1998; Bíró, 2003). A well-functioning unified education system could have reduced differences between countries and a more uniform curriculum could have brought its peoples closer to each other. In 1929, the first legislation concerning elementary and secondary schools had been adopted in Yugoslavia, during the years of dictatorship. The basic education legislations were conceived in the spirit of Yugoslavism that established the rights to basic, free and compulsory education for all (Bíró, 2003). Yugoslavia capitulated during World War II (Bács, 1983; Bence, 1994; Szilágyi, n.d.; Gulyás, 2009). In 1939, they regulated education in lyceums and in regions where minorities were in the majority, they allowed classes for the minorities in the institutions (Székely, 1998).

In 1974, Croatian high school education in the then current form was discontinued, and the entrance examination in secondary education was abolished, this way 94% of students continued their studies (Sokcsévits, 2004; Császár, 2006). In Slovenia, a legislation on the organization and financing of education had been passed in 1991 (Ministry of Education, Science and Sport, 2003; Plut-Pregelj, 2011). After Croatia became independent, it wanted to change its education system, but due to war conditions, it was only possible to make structural changes, so it was not until the late nineties that planning could be started and the changes were actually implemented in the academic year starting in 2005. In the year 2000, a new government had been elected in Croatia which decided upon new priorities within the field of education, such as decentralization and more curriculum options. In 2006, Montenegro proclaimed its independence, thus Yugoslavia ceased to exist, the northern part was named Serbian Republic (Jelavich, 1996; Cox, 2002; Isaszegi, 2012). In Serbia the legislation about the fundamentals of the education and school system has not changed since 2009. Slovenia joined the EU in 2004, Croatia in 2013, and Serbia is currently one of the candidate countries for membership of the European Union (European Commission, 2016; European Union, 2017).

2. Former Studies

Many former studies were structured (Dolence, 2003, Réti, 2015; Smith, 2000) in a way that divided factors of analysis into main groups, and examined these factors to highlight the

possible differences and similarities. Ince and Yildirim (2018) have compared Turkish and Canadian science curricula for 5th graders. The aspects analyzed were the following: (1) the philosophy of education, (2) main goals, (3) fields of study, and (4) assessment. The results have clearly shown that there are similarities between the two materials examined in their philosophy of education and main goals, since both systems stress the importance of conveying conscious, scientific thinking to students. The study has found five fields of study in Turkey and four in Canada, which cover the same material, more or less. The major difference was in assessment, since in the Turkish system, the objectively oriented tools of assessment and self-assessment were used, whereas the Canadians stressed measurement based on quantitative output (Ince & Yildirim, 2018).

Creese, Gonzalez and Isaacs (2016, pp. 6-7) have designated nine aspects to be considered when comparing different national curricula and education systems. The areas were the following:

- (1) *The goals or aims of the education system and how these are embodied in the curriculum;*
- (2) *How centralised or decentralised management of the instructional system is;*
- (3) *Principles and methods of accountability and their link to instructional systems;*
- (4) *What compulsory and optional subjects are included in the programme of study in primary and secondary school levels;*
- (5) *To what degree curriculum is organised by discipline or integrated across disciplines;*
- (6) *How twenty-first century skills are embedded in the curriculum;*
- (7) *The clarity and content of curriculum for secondary vocational pathways;*
- (8) *Whether curriculum is common or differentiated;*
- (9) *How assessments are created and what stakes they have and for whom.*

The study examined the education systems and target areas of six 'high output' countries: Australia (New South Wales and Queensland), Canada (Alberta and Ontario), China (Hong Kong and Shanghai), Finland, Japan and Singapore, and two U.S. states (Massachusetts and Florida). They have concluded that all systems examined offer an all-encompassing education directive on a national level, but local aspects aiding the acquiring of skills relevant in the 21st century are also included. They found differences in the general patterns, too, such as scheduling and division of time between topics. These countries have different systems of self-assessment, some countries rely on internal assessment, while others place importance on international surveys. For instance, Japan does not participate in international audits, but relies on surveys conducted among students, whereas China has a strict internal system of planning, validation and regular assessment of their education system (Creese et al., 2016).

3. Methodology

I have designated the four main topics based on former studies (Creese et al., 2016; Ince & Yildirim, 2018; Réti, 2015). These are the following: (1) the main goals of the education system; (2) the directions of education (regulations and

types of curricula); (3) the content of mathematic curricula; (4) the system of assessment. My inquiry is based on analysis of documents, relying on primary sources (legislation regarding education, national education directives, decrees) and secondary sources (national reports, OECD reports, academic literature). Regarding the first topic, I have examined current legislation and highlighted the main similarities, which are somewhat similar in all nine countries. While examining the second aspect, I have examined the levels on which decision-making happens and how centralized the given system is, as well as examining the level of autonomy of the local schools in the adherence to the national directives. Thereafter, I compared the way these given systems are structured, the number of compulsory classes, and the content of mathematics curricula (3). Both PISA and TIMSS include the subject in their survey, and each country examined showcases great appreciation for the subject, it has not really been affected by the education reforms of the past decades, and it is compulsory in all grades in elementary school. In the fourth topic, I have compared the assessment system of each country. This way, the study goes from the general to the specific, while narrowing its scope until it arrives at examining 8th grade mathematics education. In order to make my argument more understandable, the relevant academic literature is included in the given sub-chapters.

4. Comparison

(1) Main goals of the education systems

All nine countries have set similar goals, which almost completely correlate with each other. The fundamental goal of elementary education in these countries is to support and enhance the general development of pupils. They devote attention to the intellectual, emotional, physical, social, and moral safety of the children. The goal of education is defined as supporting the children in acquiring a high level of knowledge, skills, and right attitudes, including the linguistic, mathematical, cultural, technical and IT competences necessary for modern life. Another similarity is that all nine systems consider it fundamental to develop key interpersonal competences and synchronize these with the recent results of research in technology and science, as well as highlighting the importance of retaining these competences, and developing them through life-long learning (Chlon-Dominczak, 2017; Eurydice, n.d.; IBE, 2011; Mullis et al., 2016; OECD, 2017a, b; Republic of Croatia Ministry of Science, Education and Sports, 2010; Rica, Popa, & Bucur, 2016).

The main goals of these systems are in accordance with the directives of the European Council, that is to enhance the skills of students by 15 years of age in the fields of reading and writing, mathematics, and science (European Commission 2018; Eurydice, n.d.). Additionally, the Ministries of Education have set the goal of ensuring and enhancing the quality of education, their accessibility, relevance and effectiveness, and to create an effective network of educational institutions. Therefore, all countries examined strive for synchronizing economic and social policy with their systems of education.

The values and goals of education are seen as compulsory for all teaching and other staff at educational institutions, in each cycle and for all levels. In order for schools to contribute to achieving policy goals, they are encouraged to cooperate with the ministries, families and local city councils (Creese, Gonzalez, & Isaacs, 2016; Czech Eurydice Unit, 2017; Eurydice, 2015b; OECD, 2016, 2017b, c; Velkey, 2015). Based on these, we can distinguish and discuss separate fields within the general goals of education systems.

(2) Education directives

Regulation

Most systems of education require centrally-set minimum requirements in order to unify the conveyed body of knowledge within the system, so that students can expect the same level of attainment on different levels and mobility becomes possible, and requirements are in accordance with learning materials (Bárdossy, 2006; Réti, 2015). Setting education policy is achieved by the creation of national curricula. Each country has its national laws concerned with public education, which are supplemented by lower-level regulations and decrees, that create a general framework of regulations (Molnár, 2013). Among the tools of central regulation of content, we can find curriculum competences, study elements, study programs, textbooks and other supplement materials, as well as exams and other forms of assessment. Content regulation designates the nature and extent of knowledge conveyed by public education, encompassing both input (curricula, tools) and output (exams, assessment) elements, and their systems of implementation (Báthory, 2000; Molnár, 2013; Réti, 2015).

Country	Regulation
Hungary	central legislation, heavily centralized education system
Romania	central legislation, centralized and centrally assessed system
Serbia	central legislation, centralized system with elements of free choice
Croatia	central legislation, lightly centralized systems
Slovenia	central legislation, presence of more independent local systems
Austria	central legislation, municipal execution, regional differences
Slovakia	central legislation, municipal regulation on the elementary level
Czech Republic	central legislation, regional and municipal decentralization
Poland	central legislation, locally decentralized system

Table 1: Regulation of elementary education in the countries examined.

In Hungary, the central government is responsible for the directives of the education systems (Ministry of Human Resources). The maintenance of the system is more centralized and legislation makes the large-scale centralization of funding and content regulation possible (Eurydice, n.d., 2018c, d; OECD, 2015a, b). The Romanian system designates three separate levels: national level (Ministry of Education), central level (ministerial cooperation), and local level (school districts). The Ministry is responsible for the local implementation of central education goals through county-level school districts (Eurydice, n.d., 2018c; Mullis et al., 2016; OECD, 2017c). The Serbia education system is heavily centralized, especially when it comes to funding, but elementary educational institutions have a level of great independence (Eurydice, n.d., 2018c, d).

In Croatia, there is a national curriculum, but legislation has made possible the decentralization of funding and management, providing a high level of independence for local municipalities (Eurydice, n.d.; IBE, 2011; Kovačević,

2018). In Slovenia, the management of education is divided between the national government and local institutions. The central, national legislation designates the goals of education, but these are implemented and self-assessed on a local level (European Commission, 2014; OECD, 2016). In Austria, decision-making is divided between the central government, the constituent states, and the schools themselves. Institution managers are responsible for developing the education goals of institutions and the finances of the institutions (Eurydice, 2018d; OECD, 2017, a,b). In Slovakia, there are three levels of the centralized system, the national, the regional and the local level. Central authorities provide the framework for education, regional authorities manage high schools directly, while elementary and other institutions are managed and developed by local governments (Eurydice, 2009, 2018d; Shewbridge et al., 2014; Statistical Office of the Slovak Republic, 2011).

In the Czech Republic, there are two levels of their decentralized education system, the municipal and the regional level, which are considered of higher authority. The administrative responsibilities fall on the regional level, who have a great level of autonomy, and the municipal level is responsible for ensuring the conditions of regular attendance (Czech Eurydice Unit, 2017; Eurydice, 2010b, 2011; IBE, 2011; The Ministry of Education, Youth and Sport of the Czech Republic, 2012). In Poland, the education system is maintained by two government bodies. The decrees and regulations pertaining to education are set centrally, but their implementation and management of institutions is the responsibility of the local level (Chlon-Dominiczak, 2017; Eurydice, 2010a; Ministry of National Education, 2008a; Mullis et al., 2016; Velkey, 2015). Thus, it is clear that all the countries examined have local legislation, but the structure and constituent bodies on the lower levels are different. As a result, we may speak of similarity or unity only on the legislative level, there is no unity regarding the level of centralization.

Curricula

The curriculum is a document that regulates the content of education and as such, it is a content-based tool of management. The paper relies on Molnár's definition (2013) of the curriculum: "*it is a document that designates the fundamental goals of education; these are detailed and differentiated in the forms of tasks and requirements; there are intellectual and other learning materials assigned to these; and these are organized in a teachable and learnable form.*" (Ballér, 2003; Báthory, 2000; Molnár, 2013; Mullis et al., 2016).

An important element of the twofold regulation is the national curriculum, a document upon which input and output requirements are structured, which are being continuously overviewed and developed. The national curriculum designates the basic features and general goals of a country's education system, the fundamental values and requirements, the main intellectual fields, the sequencing of public education, and the goals of development in the given sequences (Perjés & Vass, 2008; Réti, 2016; Szebenyi, 2001). The countries that have such national curricula or similar sets of programs are at the second level of central

regulation. They produce more differentiated curricula that apply the principles of the national curriculum, as well as its pedagogical values, designated key competences, and intellectual fields of study.

These curricula are different at different levels of education, but in all cases aid the local planning and the day-to-day, practical implementation of the national curriculum (Gönczöl & Vass, 2004; Molnár, 2013; Perjés & Vass, 2008). The local school curricula provide a fit for the opportunities of the given institutions, and are always based on the national curriculum. They may be the local version of the second-level curriculum, or individually designed. It is required to contain the teaching and learning goals of the institution, the subject curricula, the lesson plans, the detailed syllabus for given subjects, the end-term requirements, the utilized educational tools, and the institution's system of assessment (Ballér, 1997; Perjés & Vass, 2008).

	National curricula	Education program	Local curricula
Hungary	X	X	X
Romania	X	X	X
Serbia	X	-	X
Croatia	X	X	X
Slovenia	X	-	X
Austria	X	-	X
Slovakia	X	X	X
Czech Republic	X	X	X
Poland	X	-	X

Table 2: The level of curricula in the countries examined.

As shown in Table 2, all countries in the examined region have a core national curriculum, all other curricula are based upon this. Based on this, we may speak of commonalities and a regional unity. On the second-level framework, we can see that it is present only in 5 countries, only these five have a set of differentiated education programs. In these, the detailed syllabus is presented, as well as the educational tools and the system of assessment, the electable subjects, the minimum and maximum number of pupils attending classes, and recommendations regarding local/institutional curricula (Báthory, 2000; Czech Eurydice Unit, 2017; Eurydice, 2009, 2011; Falus, 2009; IBE, 2011; Kaposi, 2012; Kovacevic, 2018; Molnár, 2013; Mullis et al., 2016; Rica Popa & Bucur, 2016; Republic of Croatia Ministry of Science, Education and Sports 2015a, b).

In Hungary, the lowest level of curricula is the local level in which the institutions designate the number of lessons and the syllabus in strict adherence to the Hungarian National curricula and the second-level framework. In Romania, the local curriculum is created with the contribution of parents, students and other stakeholders, which is ratified by the Council of Education, and contains recommendations for all local institutions. In Serbia, teachers have a certain amount of flexibility when it comes to the implementation of the local curriculum, e.g. in some subjects, there is a preset number of compulsory classes, whereas in the case of other subjects, this can be decided by the teachers. In the case of Croatia, the school curricula are crafted with considering contributions from the staff, parents, students, and the local community. The school curricula include non-compulsory subjects, modules and other educational programs, as well. In Slovenia, institutions have the autonomy to choose the

methodology of education they deem most suitable, and designate the actual content of their curricula on their own, with contributions from the teaching staff.

In Austria, the national curriculum is supplemented by decisions of the local schools, the local options (one-third of the whole curriculum) make it possible for schools to address local differences and to increase the autonomy of their institutions. In Slovakia, the implementation of the local curriculum is done in such a way that considers the general goals set by the national curriculum, as well as the specific regional and institutional realities. In the Czech Republic, teachers can elect their own methods within the framework of the national educational programs and recommendations, which is suitable for the general policies of the institution. In Poland, the local curriculum defines the subjects and material to be acquired by students, as well as the ways to fulfill nationally designated goals and the assessment of students. Teachers can implement their individually developed curricula if they wish to do so, as long as these are in accordance with the national curriculum, similarly to other countries (Báthory, 2000; Bazic, 2011; Chlon-Dominczak, 2017; Czech Eurydice Unit, 2017; Eurydice, 2009, 2011; Falus, 2009; IBE, 2011; Kaposi, 2012; Kovacevic, 2018; Molnár, 2013; Mullis et al., 2016; OECD, 2016, 2017a, b; Rica Popa & Bucur, 2016; Republic of Croatia Ministry of Science, Education and Sports, 2010).

The structures of the systems of education

I have also examined the compulsory age of attendance and the minimum numbers of lessons, the results of which do not show commonalities.

	Beginning of compulsory education (age)	Ending of compulsory education (age)
Hungary	6	16
Romania	6	17
Serbia	6,5	14,5
Croatia	7	15
Slovenia	6	15
Austria	6	15
Slovakia	6	16
Czech Republic	6	15
Poland	7	15

Table 3: Compulsory education in the countries examined, based on the Eurydice (2018c, d) database.

Regarding similarities and differences, we may speak of three separate groups within the region (Table 3). To the first group belongs Hungary, Romania, Slovenia, Austria, Slovakia, and the Czech Republic, where the compulsory age of attendance is 6 years of age. The second group is constituted by Croatia and Poland, where the beginning of compulsory education starts at the age of 7, and the third group is Serbia, where this value is 6.5. There are four groups with regard to the end of compulsory schooling: Croatia, Slovenia, Austria, the Czech Republic and Poland constitutes the first group, where this is 15 years of age. The second group is Hungary and Slovakia, where students are required to attend school until 16 years of age. The third and fourth group are constituted by one country each, Serbia with the lowest (14.5 years of age) and Romania with the highest (17 years of age) age of compulsory school attendance.

There is also a discrepancy in the structure of elementary schools, as presented in Table 4.

	Structure of elementary school	Period of elementary school	Length of compulsory education (year)
Hungary	4+4	8	10
Romania	4+4	8	11
Serbia	4+4	8	8
Croatia	4+4	8	8
Slovenia	3+3+3	9	9
Austria	4+4	8	9
Slovakia	4+5	9	10
Czech Republic	5+4	9	9
Poland	6+3 (3+3+3)	9	9

Table 4: The structure of elementary schools and the length of compulsory attendance in the countries examined.

In the structure of elementary schools, the 8-year-long (4+4 years) is the most common in the countries examined. Besides, the 9-year-long structure is also present, depending on what particularities are more stressed in a given system. In Slovenia and Poland, elementary education is carried out in a 3+3+3 system, while in Slovakia, elementary education is carried out in a 4+5 form, whereas in the Czech Republic, it is carried out in a 5+4 system (Eurydice, 2018 a, b, c).

As we can see in the last column of Table 4, the length of compulsory education differs in the countries examined. Besides Hungary, compulsory education is longer in Romania, Austria, and Slovakia. These countries wish to reach students not only on ISCED 2 level (upper elementary education), but also to encourage them to begin and attain ISCED 3 level education (lower high school level) (Eurydice, 2018 a, b, c; Forgács, 2009).

Number of classes

The curricula of each country examined designates the compulsory number of classes, but there is a difference in the actual numbers. Table 5 shows the number of classes in a 60-minute form in the given education systems, pertaining to 8th grade classes.

	Compulsory hour of classes in the 8 th grad (1 hour = 60 minutes)	Compulsory hour in the 8 th grade – mathematics (1 hour = 60 minutes)	Mathematics classes percentage distribution
Hungary	837	81	9,68%
Romania	835	111	13,29%
Serbia	816	102	12,50%
Croatia	683	105	15,37%
Slovenia	791	105	13,27%
Austria	960	150	15,63%
Slovakia	846	113	13,36%
Czech Republic	897*	110**	-
Poland	810	96	11,85%

Table 5: The preset compulsory number of classes in the 8th grade in general and for mathematics classes in particular, and their percentage distribution (Eurydice, 2018 a, b).

*In the Czech Republic, 162 hours are required in all age groups, but schools can decide how to divide the altogether 2940 hours between the 5th and the 8th grade, therefore arriving at an average number.

**In the Czech Republic, the number of lessons (441) is divided between 5th and 8th grade.

As seen in Table 5, the countries have a similar number of compulsory hours. This number is the lowest in Croatia (683), and the highest in Austria (960) – it is important to highlight that both countries operate with a 4+4 model at the level of elementary schools. Mathematics is the second most important subject from the perspectives of curricula and compulsory number of classes. A study carried out by Eurydice (2018a) has found that the importance and length of mathematical education is especially high in Europe. We

can see the dynamic of the number of lessons in the countries examined in the second column of Table 5. The number of mathematics lessons varies between 100-113 in most cases. Austria has the highest number (150), whereas Hungary has the lowest (81). In Hungary, less than 15% of all the time spent in education is concerned with mathematics, whereas in Austria, this number is 15%, and in other countries, 12-13%. In some cases, the length of time devoted to specific subjects is not designated on a central level, in these cases, this responsibility falls to the given institutions. A good example for that is the case of the Czech Republic, where the number of lessons is individually divided between the different grades and age groups.

If we look at the subject from the perspective of 45-minutes-long classes, we find the following proportions:

	45-minutes-long classes per week	45-minutes-long mathematics classes per week
Hungary	31	3
Romania	30	4
Serbia	28-32	4
Croatia	30	4
Slovenia	28,5	4
Austria	32	4
Slovakia	30	4
Czech Republic	30	4
Poland	31	4

Table 6: The total number of 45-minutes-long classes and the number of mathematics classes per week among 8th graders in the countries examined (IBE, 2011; Mullis et al., 2016).

It is evident from Table 6 that there is no significant difference in the weekly number of classes among the countries examined. In all cases, the number of weekly classes were close to 30. In the case of mathematics, only Hungary has three classes per week, all the other countries have four per week. One could have presupposed this lower number from the previous date, which showed the lower overall hours devoted to mathematics in Hungary. Interestingly enough, the number of classes in Austria is not greater than in the rest of the countries examined. These numbers show the time devoted to acquiring the preset skills and knowledge that the students have to fully acquire in order to participate successfully in the assessment process.

(3) The content of mathematics curricula

Mathematics is not simply the study of numbers and their connections, but a creative field founded upon logical and innovative thinking. Due to its unresolved problems, mathematics is a multifaceted branch of science. While solving a task, children solve not only mathematical examples, but study the algorithm itself used for solving the given problem (Eurydice, n.d.). In the countries examined, the purpose of mathematics education is similar, among the top priorities is the enhancing of the ability of students to identify and properly contextualize mathematical data and connections; to apply basic algorithms and concepts in a given practical situation; and to analyze and correctly interpret the mathematical aspects of problematic situations, and to apply the acquired knowledge in other fields as well

(Comenius Institute, 2013; Eurydice, 2015a, b; Gasic-Pavisc, & Kartal, 2012; Ministry of Education, Science and Sport, 2015a, b; Ministerul Educației Naționale, 2017; Ministarstvo Znanosti I Obrazovanja, 2017; Mullis et al., 2016; National Institute for Education, 2010).

In my analysis, I have examined the 8th grade mathematics curricula in the countries under scrutiny. 8th grade is the age group closest to international surveys (PISA, TIMSS), students are 14-15-year-olds at this point in each of the countries, and TIMSS survey is also carried out in this grade. It can be concluded that the curricula analyzed were all content-oriented and placed importance on the more traditional fields of mathematics.

In my analysis, I relied on a former study "What can we learn from the English, mathematics and science curricula of highperforming jurisdictions?" (Department for Education, 2011), in which mathematics curricula were analyzed in a comparative fashion, in order to gain insight into their commonalities and differences which may be utilized in the methodological development of English language teaching. The study designates five specific fields to be examined (Department for Education, 2011). Of these, I have used four to be examined in 8th grade mathematics curricula.

	Arithmetic and algebra	Series, connections, and functions	Geometry	Statistics and distribution
Hungary	X	X	X	X
Romania	X	X	X	-
Serbia	X	X	X	X
Croatia	X	X	X	X
Slovenia	X	X	X	X
Austria	X	X	X	X
Slovakia	X	X	X	X
Czech Republic	X	X	X	X
Poland	X	X	X	X

Table 7: Contents in 8th grade mathematics curricula in the countries examined (Comenius Institute, 2013; Eurydice, 2011; 2015a, b; Gasic-Pavisc & Kartal, 2012; Ministry of Education, Science and Sport, 2015a, b; Ministerul Educației Naționale, 2017; Ministarstvo Znanosti I Obrazovanja, 2017; Mullis et al., 2016; National Institute for Education, 2010).

In Table 7, we can see that all fields are present in the curricula of the countries examined, there are no significant differences. The content is largely the same, there are differences in the details, but the main features are the same. In the fields of arithmetic and algebra, it is deemed important for students to be able to apply the basic operations without any difficulty. They must be aware of fractions, quantities, and proportions, and they must be able to calculate with negative numbers and to calculate percentages. In certain countries such as Poland and Croatia, even the basics of root calculation are introduced by this point. A further requirement is to be familiar with series, connections, and functions, to be able to analyze linear equations and interpret and visualize functions. Students must also be able to analyze and interpret diagrams and graphics. When it comes to geometry, students are expected to be familiar with geometric shapes, to be able to calculate area, perimeter, surface and volume, to measure angles in degrees and to be familiar with the Pythagorean theorem. In most countries, statistics and probability is less emphasized, although basic statistics and distribution is present in the curricula of each country. The only country where the fields of statistics and probability are excluded from the 8th grade curriculum is Romania (Comenius Institute, 2013; Eurydice,

2011; 2015a, b; Gasic-Pavisc, & Kartal, 2012; Ministry of Education, Science and Sport, 2015a, b; Ministerul Educației Naționale, 2017; Ministarstvo Znanosti I Obrazovanja, 2017; Mullis et al., 2016; National Institute for Education, 2010).

The analysis yields that greater attention is devoted to the fields of algebra and geometrics, while probability is only a minor part of the average curriculum. The content of the different curricula does not differ greatly, the only real difference, as we have mentioned above, is the time devoted to mathematics as a field and to the respective subfields. Otherwise, our analysis shows unity and commonality in mathematics curricula in the countries examined.

(4) System of assessment (mathematics)

The designation of effective assessment strategies is important in order to enhance the attainment of students and in the creation of a better, more just system of education. Each country strives for participation in international surveys, where mathematics is one of the main fields measured. Each country has their own internal system of assessment, and all of them participate in international surveys. The periodicity and reliability of these surveys is a significant priority for these countries, for these surveys provide stakeholders in education policy with a realistic image of the ability and attainment of the given age group who are about to finish elementary education, as well as a realistic image of the effectiveness of education policy and institutions (Eurydice, n.d.; IBE, 2011; Mullis et al., 2016).

PISA							
Hungary	2000	2003	2006	2009	2012	2015	2018
Romania			2006	2009	2012	2015	2018
Serbia		2003	2006	2009	2012		2018
Croatia			2006	2009	2012	2015	2018
Slovenia			2006	2009	2012	2015	2018
Austria	2000	2003	2006	2009	2012	2015	2018
Slovakia		2003	2006	2009	2012	2015	2018
Czech Republic	2000	2003	2006	2009	2012	2015	2018
Poland	2000	2003	2006	2009	2012	2015	2018

Table 8: Countries participating in PISA assessments in the given years.

TIMSS – 8 th grade						
Hungary	1995	1999	2003	2007	2011	2015
Romania	1995	1999	2003	2007	2011	
Serbia			2003	2007		
Croatia						
Slovenia	1995	n.d.	2003	2007	2011	2015
Austria	1995					
Slovakia	1995	1999	2003			
Czech Republic	1995	1999		2007		
Poland						

Table 9: Countries participating in TIMSS assessments in the given years.

As shown in Tables 8 and 9, the countries examined have continuously been participating in PISA surveys since 2006 (with the exception of Serbia in 2015), and to a lesser extent, in TIMSS surveys (Eurydice, n.d.; Mullis et al., 2016; Oktatási Hivatal, 2016; Vári, 2003). These surveys allow us to trace the levels of attainment in mathematics, which can be compared to other countries this way.

Reviewing international results, Hungary has a national test to measure the mathematical and reading skills of students

in the 6th, 8th, and 10th grades. This test does not assess textbook knowledge, but focuses on the application of students' skills and knowledge in real-life situations. In Romania, there is a compulsory exam in mathematics in the 8th and 12th grades, which greatly affects the education of the subject. Schools in the country use the diagnostic insights only to a limited extent, which reflects the limits of national support and local capacity.

Since the 2013-14 school year, students in Serbia are expected to sit a final exam in mathematics, among other subjects, which is a valuable tool in measuring student skills on different levels. In Croatia, there is a National Center for the External Assessment of Education, which is responsible for conducting national education assessments. Students are required to participate in a mathematics exam in the 8th grade, the results of which are distributed back to the schools, encouraging them to self-assess. In Slovenia, 6th and 9th grade students are assessed in three distinct fields at the end of the school year. These are prepared by the National Exam Center, and are aimed at examining student attainment relative to the minimum requirements designated by the national curriculum, but the results do not affect the marks of students. In Austria, students participate in national tests at the end of lower high school terms (8th level) in a number of topics, including mathematics.

Since 2005, students in Slovakia are required to participate in tests at the end of their participation in elementary education, which measures their attainment in various fields, including mathematics. In the Czech Republic, students do not participate in regular national or regional assessments. Schools are not expected to participate in standardized testing, but the majority of them do so. Czech authorities have created a digital system of assessment, which provides an opportunity for assessing certain fields, which vary year by year. In Poland, students participate in an external exam at the end of their elementary education (9th grade, 16 years of age), including mathematics, but these results do not directly affect their institutional choice for further studies, but might be considered in the case of over-application or setting gradation among students in a given institution. External assessment (national, international) is aided in every country examined by internal assessment, therefore tracing the development and attainment of students, and concluding those results in a conclusive and formative manner (Blagdanic, Pesic, & Kartal, 2009; Central Statistical Office, 2011; Czech Eurydice Unit, 2017; Eurydice, n.d., 2015a, b, c; Gasic-Pavisc & Kartal, 2012; Government of the Republic of Croatia, 2016; Kitchen et al., 2017; Ministry of Education, Science and Sport, 2015a, b; Mullis et al., 2016; National Institute for Education, 2009, 2010; OECD 2015a, 2017a, c; Oktatási Hivatal, 2012; Specht & Sobanski, 2012; Statistical Office of the Republic of Slovenia, 2015; World Bank, 2011).

5. Discussion and conclusion

The education systems of the region show unity and a great number of commonalities in certain fields, whereas differences are present in other fields. In each country,

there is a heavily centralized system of education achieved through national legislation, but this is further divided and differentiated to lower levels of execution and assessment. It is clear that despite the centralized nature of these systems (Hungary, Romania), there are more decentralized structures at the lower levels, where municipalities and local managers can make individual choices in accordance with national directives. Based on these peculiarities, we may speak of only a partially unified region in this sense, since the lower levels are different to certain extents.

The countries examined are unified in the sense that each country has a national curriculum, which is centrally designated and all public institutions of elementary education are required to adhere to the values and goals of these. Besides, there are second-level programs/curricula, which define the further details of the structure of education, such as the list of compulsory subjects taught, etc. In the majority of cases, this is included in the national curricula of the countries examined, but as a result, we may only speak of unity in the case of five countries. Every country has local/institutional curricula, which aid the autonomy and free choice of institutions, but the extent of these vary greatly in the region.

There is a great variety in the ways the education systems are structured in the region. There are minor differences in the compulsory number of classes in mathematics, but the weekly allocation is the lowest in Hungary, which might explain the lower attainment results, since there is less overall time for conveying and acquiring the skills and knowledge largely similar to other countries.

The mathematics curricula are largely similar in each of these countries. The only minor difference is in Romania, where one field is completely absent from elementary education, which might explain why examples of these kind are harder for Romanian students in an international assessment without prior exercises and practice. Overall, there is a high level of commonality in the topics included in the mathematics curricula of the region.

Another commonality in the countries examined is that they participate in international surveys such as PISA and TIMSS, but the further breakdown (which grade, which topics, which age group) shows differences. The periodicity and reliability of such assessments are important for all countries examined. Each of the countries has a national exam for assessment, though participation is not compulsory everywhere (e.g. Slovakia). However, all the countries have some sort of an internal system for assessment, the result of which is that there is a certain level of regional commonality regarding this field as well.

My paper presents and compares the current situation, but this might change in the near future due to a number of factors, e.g. the introduction of the new national curriculum in Hungary. After the introduction of reforms, countries mostly followed their own path to achieve their preset goals, to enhance the quality of their systems and their attainment results. Can we speak of a unity and high level of commonality in the present situation? Yes, to a certain extent, but we must also highlight that there are a number

of differences, which might very well explain the different results of the countries in international assessments and the varying effectiveness of these education systems.

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