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# *Mathematics Education in the Balkan Societies Up To the WWI*

***Abstract:*** *Whilst the world is indebted to the Greeks for their development of geometry and to Islamic mathematicians for their development of algebra, the history of violence and wars of the Balkan peninsula meant that neither heritages of these two great mathematical cultures survived into the 19th century. This paper is based on the research done for the history of mathematics in the Balkans and will be limited to the development of mathematical education in three Balkan societies: Greek, Ottoman, and Serbian, culminating in the early 20th century. It will try to explain how the three cultures of mathematics education were conceptualized, and how their development was influenced by the mathematical cultures of Western Europe. The systems of schools and universities, the first professors of mathematics at the universities in the three countries, mathematical syllabi, and some of the first textbooks in mathematics will be mentioned.*

***Key words:*** *19th century mathematics education, Balkan mathematics, Greek mathematics, Ottoman mathematics, Serbian mathematics.*

## Introduction

This paper focuses on the development of Balkan mathematics education, which will be covered through the history of three national schools of mathematics. In particular, it deals with identifying and describing the types of institutions in three societies of the Balkans in the latter part of the 18th and most of the 19th century. First, we will look at the mathematics of the ruling Ottomans, and examine how mathematical culture developed under the programme of modernization of the Ottoman state and their military apparatus. The second focal point will be the mathematics of two Orthodox populations then under the Ottoman Empire: Greeks and Serbs. Greeks were the predominant Orthodox *ethnie*, both in terms of their heritage and cultural influence, and the wide spread of the Greek diaspora, with merchant communities scattered throughout the Empire, gave them an enviable position in terms of their ability to import learning from foreign countries. Finally, we will look at the particular and relatively small national mathematical culture, that of Serbia, and examine a personal story that

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contains many ingredients considered typically Balkan, interwoven with a love of mathematical studies.

### The Mathematics of the Ottomans

The Ottoman Empire (1299–1922) at the height of its power in the sixteenth and seventeenth centuries spread across three continents, from south eastern Europe, to north Africa and the Middle East, and included territories from Gibraltar to the Persian Gulf and from modern-day Austria to Sudan and Yemen. The relative religious tolerance meant that non-Islamic *ethnies* were allowed to profess their faith.[2] Until the end of the eighteenth century learning developed slowly in the Balkan principalities.

The Ottomans developed schools known as *madrasas*, (literally meaning 'place where learning is done) which were founded throughout the Muslim world from the ninth century. The primary aim of madrasas was to instruct in the science of jurisprudence. It is significant to note that certain madrasas included teaching on 'rational' sciences such as logic, ethics, Arabic language subjects, and arithmetic, apart from the religious and jurisprudence subjects. It is however, generally believed[3] that individual madrasas included mathematical sciences and astronomy if the madrasa professors studied such sciences and were therefore immersed themselves in such subjects.[4]

Students entered madrasas after their basic schooling in the *mektebs* (equivalent to primary schooling), and spent years rising through the ranks (twelve in total) corresponding to the ranks of their teachers. After completing studies in madrasas, a student may become a tutor, enter the teaching profession or, if all he had completed all grades, enter the *ulema* hierarchy becoming a learned man or a religious cleric. This type of education was based on tradition, and the handing on of existing knowledge, rather than the development of new concepts (Zilfi, 1983). The major challenge to this system, through wider political developments, came after the Ottomans lost the Battle of Vienna in 1683. The Ottomans subsequently fought a number of wars with the Russians, eventually establishing the Habsburg-Ottoman-Russian borders in southeast Europe. At the same time they lost large areas of the Empire, such as Egypt and Algeria, to Britain and France. The Ottoman government therefore became increasingly concerned by two major problems: the loss of power and influence on the one hand, and the perceived decline and corruption of the military apparatus on the other. There was hence seen to be an urgent need for modernizing of the army and the accompanying technology, which included changes in the learning of mathematics.

At its core, this modernizing process was not motivated by ideas of Western Enlightenment. Rather, the Empire sought to create an educational system geared towards meeting military needs by introducing Western engineering and scientific learning. The importation of western sciences therefore related to the art of war rather than to peace or the pursuit of knowledge itself. One of the major problems that eventually arose through this process was that of exclusion. The new educational programme that emerged, at least for the first half-century, and its close link with the military goals, excluded de facto the many ethnic groups whose culture was linked to Christianity rather than to Islam.

2 Roudometof (1998: 12) describes *ethnie* thus as a premodern concept of identity: 'An *ethnie* may have the following characteristics to differing degrees: a collective proper name, a myth of common ancestry, shared historical memories, some elements of common culture (e.g., language, religion), an association with a specific homeland, and a sense of solidarity'. See also Smith (1986: 40).

3 Under the reign of Kanuni Sultan Suleyman (1495-1566) this trend was most widely spread, but became less common after the end of the 16th century. See Sürmen, Kaya, Yayla, (2007).

4 See Lawrence (2008).

However, as the French and Turks had a long history of cooperation since the sixteenth century, when France received permission to trade in all Ottoman ports, the French and then other Western mathematics came into the Ottoman Empire eventually through this channel.

First, a Naval Engineering College was founded in Istanbul, at the Golden Horn – a fresh water estuary dividing old and new Istanbul – in 1773, under the guidance of Baron de Tott.[5] A Military Engineering College was established in 1795, with a mathematical syllabus almost identical to that of the Naval College, but with the additional subject of fortification. These two institutions were the first in the Empire to teach modern mathematics, focussing on the sciences and their application to military and civil engineering, and departing from the traditional Islamic teaching of the madrassas. The two colleges later merged and were, in effect, the origin of the Istanbul Technical University.

Among the first group of teachers at the Naval Engineering College was Gelenbevi Ismail (1730-1790), who is credited with introducing logarithms to the Empire. The second generation of teachers initiated a more organised programme of western mathematics by translating texts into Turkish. Huseyin Rifki, for example, who taught at the Military Engineering School became a prolific translator of western works. This was a part of the wide-ranging sentiment among the Ottoman scholars to increasingly look to the West rather than East, or to re-examine the Arabic mathematical heritage (Sürmen et al., 2007). Rifki's most important work, in collaboration with Selim Ağa, an English engineer who converted to Islam, was a translation of Bonnycastle's edition of Euclid's *Elements* (1789). Until this translation appeared in 1825, the teaching of Euclid came through the Arabic translation (c. 800) which was then modified by Bursali Kadizade-i Rumi (1338-1449) who was a head of Samarkand madrasa and published shortened and simplified versions of *Elements* under the title EsKalü't-te'sis (c. 1400).

Rifki's example tells of an overwhelming need to translate original works into national languages into from the western sources rather than from the existing translations of the original work. The practice indicates that the importation of western ideas of mathematics and of education corresponded with the production of new ways of learning even of the things that were already known. This phenomenon is an interesting one that perhaps requires further documentation and consideration, as it indicates that the western sources seemed to be deemed more suitable for the purpose of teaching at the newly established institutions of higher learning, rather than the original, native sources.

Perhaps this is because at the beginning of the nineteenth century Ottoman mathematics was strongly influenced by military preoccupations, and was mostly limited to the translation of French and English texts for use firstly, in the newly established military engineering colleges, and later for the use in teacher training colleges. The mathematics found in French and English sources was deemed modern for such uses. Likewise, the training into such mathematical culture became necessary. Kerim Erim was the first Ottoman mathematician to be granted a PhD in mathematics in 1919, at the Friedrich-Alexander University of Erlangen.[6]

As a consequence, because the local cultural tradition was abandoned in favour of the modern western mathematics (and it takes time for a community, as well as an individual, to become masterful in any discipline if learning is undertaken from the very beginning) very little of any original mathematics was done before the First World War. The second reason was also probably due to the mastery, or the lack thereof of the language skills to first learn, and then communicate results with the West-

5 According to Baron de Tott's memories, published upon his return to France in 1773. See De Tott (1785). De Tott was a French diplomat of Hungarian origin.

6 His thesis was entitled *Über die Trägheitsformen eines Modulsystems* as reported by İnönü (2006: 234-242).

ern mathematical communities. A rare case is that of a secondary school headteacher Mehmet Nadir, later becoming first professor of mathematics (1915) at the newly established University for Women (established in 1914 in Istanbul) and chair for number theory at the Istanbul University (1919), who obtained interesting results in number theory, particularly in relation to Diophantine equations (İnönü, 2006). Very little effort was also directed towards communication with Western mathematicians: Nadir did so, as did his contemporaries at the end of the 19th century – Tevfik Pasha and Salih Zeki both published in either foreign languages or in foreign journals – former wrote a book on algebra published in English under the title *Linear Algebra* (second edition 1893), for instruction at the teachers' colleges, and latter published an article on "Notation algébrique chez les Orientaux" in the *Journal Asiatique* in 1898.

**Mathematics of Modern Greeks**

The Greeks, after the collapse of the Roman Empire, found themselves under the Ottomans for centuries, but their diaspora spread as far as the Black Sea coast and the Venetian territories. Greek communities flourished in cities such as Vienna, Amsterdam, or Budapest on the one hand, and played an important role not only in commercial development, but in supporting the intellectual and cultural progress of Greeks and other Orthodox ethnies within the Ottoman Empire on the other. They did so by publishing books and newspapers in Greek, and enabling local Greek teachers to undertake university studies in the West.

One example of this practice was the education of Evgenios Voulgaris in the universities of Venice and Padova, supported by the brothers Lambros and Simon Maroutsis. Voulgaris focused on the re-establishment of ancient teaching in mathematics, believing classical Greek geometry to be the basis for any further progress (Roudometof, 1998). His view was that the uses of mathematics are valid in their interconnection with philosophy, rather than in experimental sciences. Thus the new ontological context of the Enlightenment escaped him, as it did some of his followers (Dialetis et al., 1997).

Voulgaris however also translated many philosophical and some mathematical works into Greek, among them, in 1805, Euclid's *Elements* from Tacquet's 1722 edition. *Elements* were first translated into Greek, albeit not of the 'modern Greek' variety, in 1533 by a German theologian and scholar Simon Grynäus (1493-1541). This edition included Proclus' *Commentary* on the first book of Euclid's *Elements*, given to Grynäus by the then president of Magdalen College Oxford, John Claymond.[7] The original manuscripts of ancient Greek origin were, by this time, not available.[8]

The areas around Thessalonika, the eastern Aegean, and the Ionian islands were the most significant in introducing new educational trends into Greek culture at the beginning of the nineteenth century, especially into mathematics. The intellectual prestige of these areas was related to sea trade which brought with it relative prosperity and the exchange of new ideas about learning. The centre of this new learning in Thessaly became Ampelakia, at the foot of Mount Olympus, where a school was founded in 1749. In the Aegean, the centres were Chios, Kydonies, and Smyrna. Academies were founded in Kydonies and Smyrna in 1800 and 1808, respectively (academies offering the equivalent of the undergraduate studies). The Ionian Islands were under British protection between 1814 and 1864, during which time the Ionian Academy,

7 This edition is now at the Brown University Library, US.

8 Kastanis (2006: 7) said of this: "It is well known that all Byzantine manuscripts of ancient Greek origin were pillaged, destroyed, or sold after the fall of Constantinople (an abomination beginning with the crusades from 1204-1261). Thus, the scientific works of the Greek civilization of antiquity, like Euclid's *Elements*, were missing both in the libraries of Neo-Hellenic communities and in those of the Orthodox monasteries, and it was extremely difficult for Greek scholars to access them."

established in 1824, introduced a Western model of mathematical education. Examples of teachers who taught mathematics in these institutions after training abroad are Veniamin of Lesvos, who studied at Pisa (supported by the Greek community at Livorno) and then taught at Kydonies from 1796, Dorotheos Proios who studied in Pisa and Paris and after 1800 taught at Chios (Kastanis and Kastanis, 2006), and Ioannis Carandinos, who studied at the École Polytechnique in Paris and later became Dean of the Ionian Academy.

The first translations into Greek of modern works on mathematics were done by Spyridon Asanis, a medical doctor who taught mathematics at Ampelakia in the 1790s. His translations drew on work by Nicolas-Luis de Lacaille (1712-1762) and Guido Grandi (1671-1742), and two of them were published: *Arithmetics and algebra*, in Venice in 1797, and *Conic sections*, in Vienna in 1803.[9] The success of these two books encouraged several further translations by others.[10]

Lacaille's work was then taken upon at the Greek Academy in Jassy by Iosipos Moisiodax (1730-1800). Lacaille was also very popular in both Italy and Austria during the second half of the eighteenth century, being introduced into their educational systems by the Jesuits (Kastanis and Kastanis, 2006). As majority of the Greek translations of western works were done through Venice it is conceivable that this is how Lacaille was introduced into Greece too.

Carandinos, who set up an undergraduate mathematics department at Corfu translated all the French books that he thought necessary and similar to those used in similar institutions in Western Europe. Between 1823 and 1830, he translated works by Bourdon, Biot, Lagrange, Poisson, Monge, Lacroix, and Legendre (Kastanis, 1998; Phili, 1998). Hence virtually all the mathematics studied at the Academy was pursued through the work of French mathematicians. Although French mathematics predominated in the Greek academies of the time, there were also other influences. Constantinos Koumas (1777-1836), for instance, studied at Vienna from 1804 to 1808 and completed his doctorate at Leipzig (Kastanis and Kastanis, 2006). His approach to mathematics is described as 'Austrian scholastic' (Kastanis and Kastanis, 2006) in as much as that his main focus in studying mathematics was made based on the work of Jean-Claude Fontaine, and he published in an eight volume work done by Fontaine and published in Vienna in 1800.[11]

The German influence could be traced between 1810 and 1820, and was brought into Greece by two mathematics teachers, Stefanous Dougas (1765-1829)[12] and Dimitrios Govdelas (1780-1831).[13] They introduced a German-inspired educational environment into the Patriarchic School of Constantinople and the Academy of Jassy. Bavarian officials also influenced the Greek educational system after the appointment of the Bavarian prince Otto Wittelsbach as King of Greece in 1832, to some extent. They established a system of secondary education divided into lower and upper Gymnasium, introducing a first syllabus in mathematics which gave much freedom to the teacher but prescribed

9 The original works were de Lacaille (1741) and Grandi (1744).

10 See Kastanis and Kastanis (2006: 518-520). Algebra was then extended by the study and publications of three scholars: Zisis Kavras (1765-1844) who studied in Jena and translated works from German; Dimitrios Govdelas (1780-1831) who studied in Pest and wrote a volume on Algebra relying on German sources; Stefanos Dougas (1765-1829), student of Halle, Jena and Göttingen, who published a four-volume work on arithmetic and algebra inspired by German tradition in Vienna in 1816.

11 Koumas (1807), Fontaine (1800).

12 See Dougas (1816). Dougas studied at Halle, Jena and Göttingen, publishing upon his return to the Balkans a four-volume arithmetic and algebra based on his learning of mathematics in these German cities.

13 Govdelas studied in Pest, where he wrote a volume on algebra. This work was published in Halle in 1806, under the title *Stoicheia Algebras* (Elements of Algebra). Upon his return to the Balkans he wrote a book on arithmetic and published it in Jassy in 1818. See Kastanis and Kastanis (2006: 519).

the general outline of study and the number of hours taught in schools. The emphasis was on classical studies, although mathematics was placed as a third most important subject after ancient Greek and Latin. Teaching of mathematics was heavily dominated by the teaching of geometry based on Euclid, and on Diesterweg's principles of teaching geometry based on heuristic or discovery learning.[14] The insistence on classicism and the fact that there was not enough mathematics teachers to populate the system, meant that there was a need for suitable textbooks, which were provided through the Bavarian connection. Georgios Gerakis for example, originally a teacher in a school in Athens, after his studies in Germany (enabled by the support from the state) published textbooks in Greek based on German textbooks: *Elementary Geometry and Trigonometry* (1842),[15] *Arithmetic and Algebra* (1855), and *Plane Geometry and Stereometry.*[16]

**Serbian Mathematics**

The history of Serbian mathematics is inextricably interwoven with the colourful lives of several of its most prominent exponents. Apart from tracing their stories, and as this special edition of the journal originates from within Serbia, it is quite interesting for us to see the origin of the Serbian modern mathematical culture.

Serbian mathematics education in the nineteenth century developed first under the rule of the Ottomans, and after 1833 under the Austro-Hungarian Empire. The first book on mathematics in Serbian was *Nova serbskaja aritmetika* (New Serbian arithmetic) (1767) by Vasilije Damjanović, but undergraduate education was established only in 1838, at the Lyceum in Kragujevac. The first mathematics professor there was Atanasije Nikolić, who had studied in Vienna and Pest, and his initial task was to write the first undergraduate textbooks in the Serbian language.

Belgrade University grew out of a succession of institutions, the most prominent being Matica Srpska, literally 'the Serbian Queenbee', founded in 1826 in Pest to promote Serbian culture and science. This institution grew into the Lyceum, and the Lyceum developed into the Superior School. The first trained mathematician to teach at the Lyceum, Dimitrije Nesić, had been educated at Vienna and Karlsruhe Polytechnic, and is credited with defining Serbian terminology for all mathematical concepts and processes known at the time.

At the end of the nineteenth century several Serbian mathematicians studied for doctorates at Western universities: Dimitrije Danić at Jena (1885), Bogdan Gavrilović at Budapest (1887), Djordje Petković at Vienna (1893), Petar Vukićević at Berlin (1894), and finally, the most famous Serbian mathematician, Mihailo Petrović, who completed his thesis in the same year (1894) in Paris. It is not known why Petrović chose Paris when all his contemporaries had studied in Germany or Austria, but he established important links with the French government during his studies and maintained them later. Thus, although most educational influences in the middle of the century were Austro-Hungarian or German, the most prominent of Serbian mathematicians, who set the future direction of the national mathematical school, introduced French mathematics and French mathematicians to his country.

Petrović, who was from a well-to-do family in Belgrade, completed a degree in natural sciences at the Superior, or sometimes called the Great School in Belgrade in 1889. He then went on to study at the

14 Friedrich Adolph Wilhelm Diesterweg (1790-1866) was a German education thinker whose most famous work, *Wegweiser zur Bildung für deutsche Lehrer* (*A Guide to Education for German Teachers*) (1835) set out the principles of teaching based on theory of development and improvement, heavily coloured by the ideology and philosophy of neo-Classicism. See Günther (1993).

15 The original textbook being Snell (1799).

16 Both original works were written by Carl Koppe (1803–1874). See Koppe (1836) and (1836a).

École Normale, originally a teacher training institution, rather than the École Polytechnique, which earlier in the century had been the preferred place of study for Greek students. The raised prestige of the École Normale at the end of the nineteenth century may have been a deciding factor, but it is not clear whether Petrović was aware of it. He was awarded his doctorate in 1894 for a thesis was entitled Sur les zéros et les infinis des intégrales des équations différentielles algébriques. The examining commission consisted of Hermite, Picard and Painlevé. Both Petrović and Painlevé later gained friends from the political elites of their respective countries. In 1906 Painlevé became a Deputy for the fifth arrondissement, the so-called Latin Quarter. He later became Prime Minister twice, in 1917 and 1925. Petrović on the other hand, became first tutor, and later good friend of the Crown Prince George Blackgeorge (Djordje Karadjordjević, 1887-1972). Petrović and Painlevé continued their friendship upon the return of Petrović to Belgrade. At Petrović›s insistence Painlevé›s work on mechanics[17] was translated by Ivan Arnovljević and published in 1828 in Belgrade as a textbook under the title *Mehanika* (Mechanics).

Petrović also made friends with Charles Hermite, who had already had another Serbian student, Mijalko Ćirić. Hermite taught Petrović higher algebra, and his son-in-law, Emil Picard, was another of Petrović›s examiners. Petrović and Picard became life-long friends, and Picard drew on work from Petrovitć›s thesis in his Traité d›Analyse (1908).[18]

Upon his return to Belgrade in 1894, Petrović was made a professor at the Superior School in Belgrade. At the beginning of 1905, the Superior School was replaced by the University of Belgrade and Petrović was appointed to the Chair in Mathematics, a position he held until his death in 1943.

Serbia changed relatively rapidly from having little or no mathematical culture at the beginning of the nineteenth century. There were some advantages to this relatively short history. At the International Conference on Mathematics Teaching (La Conférence International de l'Enseignement Mathématique) in Paris in April 1914, the Serbian representation reported that the introduction of infinitesimal calculus into schools was devoid of problems in their country, modernization did not pose a problem in a place where there was no tradition which could inhibit it:

> 'Chez les nations qui ont à peine dans leur développement, passé les premiers seuils de la civilisation, il n'y a pas de tradition et une idée en general et surtout une idée nouvelle, devient très facilement l'idéal meme d'une generation. Par consequent, dans ces circonstances la realisation de cet ideal n'est pas empêchée ou retardée par des questions de tradition'.[19]

Petrović's work, both in terms of acknowledgement in the international community and his efforts to establish a national school (virtually all mathematical doctorates in Serbia between the two World Wars were done under his supervision)[20] established far-reaching change. This had a long term

17 Painlevé (1922).

18 Trifunović (1994: 27).

19 L'Enseignement Mathématique: "With the nations which are, but at the threshold of civilization in their development, there is no tradition and an idea in general and especially a new idea, can become very easily an ideal of a new generation. As a consequence, in such circumstances the realization of this ideal is not prevented or delayed by the questions of tradition." (1914, 16, 332–333).

20 Petrović's doctoral students were Sima Marković (gained PhD 1904, became a famous Communist and as such disappeared and lost his life in Russia under Stalin), Mladen Berić (1912), Tadija Pejović (1923), Radivoj Kašanin (1924, who became professor at the University of Belgrade), Jovan Karamata (1926, who taught mathematics at the universities of Belgrade, Götingen, and Geneva), Miloš Radojčić (1928, professor at the University of Belgrade and the University of Khartoum), Dragoslav Mitrinović (1933, professor of mathematics and founder of mathematical institutes in a number of universities of former Yugoslavia), Danilo Mihnjević (1934), Konstantin Orlov (1934, professor of mathematics at the University of Belgrade), and Dragoljub Marković (1938); these mathematicians jointly produced further 361 doctoral students during their professional lives.

effect on Serbian, and later Yugoslavian, study of mathematics in the first half of the twentieth century. In this way the influence of the French school, was felt long after his main Serbian student became the founder of the national mathematical school.

## Conclusion

The modern idea of a periphery, and in particular of societies such as those of the Balkans, lagging behind the West, which by contrast is seen as progressively onward-moving (Ahiska, 2003; Heper, 1980), implies a need to catch up with developments at 'the centre' by introducing new technologies, approach to studying sciences and mathematics, and the cultural innovations originating in the West. In the case of the Ottoman Empire, the sense of being on the periphery began to emerge at the end of the seventeenth century, which marked the beginning of the Empire's decline military prowess and influence. It was also, however, the beginning of the period during which the Ottomans began the process of Westernisation, including the adoption of Western mathematics, which entered Ottoman education mainly through the military engineering schools (Güvenç, 1998; Grant, 1999; Somel, 2001; Ekmeleddin, 2003; Gökdogan, 2005). The Ottoman effort to modernize the military, engineering, and mathematics, is an example of a periphery to which contemporary mathematics was brought and disseminated with a singular purpose in mind. In this case the periphery took what it considered useful from the West with a view to regaining military and political prestige, but filtered out other aspects of imported culture. However, and because the local cultural heritage was abandoned in order to adopt the modern, the catch-up process took a long time and the language barriers did their part in keeping the advances at a slow pace.

In the case of the Greek mathematics of the nineteenth century, the pursuit of mathematics was influenced by the centre to such an extent that the centre often set the agenda for reform in the periphery. In the case of modern Greek mathematics this is quite an extraordinary development to be seen, as virtually all modern mathematics of the 19$^{th}$ century still relied very much on Greek tradition of mathematical thinking. Nevertheless, the original Greek mathematics was lost, and the modern Greeks were re-learning mathematics from the West. This is seen in the mathematics exported by the French to the Ionian Islands, which at the time were a British protectorate. The mathematics developed at the Ionian Academy in turn impregnated all future developments in Greece after the wars of independence in 1821.

Finally, Serbian mathematics described here focuses on the small national mathematical culture. In this case, we mainly looked at one mathematician, who can probably described as the father of Serbian mathematical culture, Mihailo Petrović Alas. His deep interest in life led him to explore the North Seas as much as to search for authentic approach to doing mathematics. Alas counted among his friends the President of France, Crown Prince of Serbia, and the Gypsy musicians of Belgrade.[21] In such a setting mathematics and its narrative became embedded in the national culture, certain elements of which gave rise to an archetypal view of mathematical pursuit linked to a bohemian but also intellectually superior way of life.

With the First World War, the intellectual map as well as the political map of the Balkans changed dramatically. First, the centres of political and cultural influence changed drastically after the disintegration of the Austro-Hungarian Empire; second, whilst the choices mathematicians and mathematics educators made in the nineteenth century were often a matter of opportunities, beliefs into the routes into progressive new times, inheritance, or circumstances. The mathematicians of the new era became acutely aware of the seriousness of decisions they had to make in developing their national schools, an

21 See Lawrence (2008).

example of which is Petrović. Through this awareness they began to create their own intellectual landscape, and drew from the influences they considered most appropriate to their national circumstances.

With the Russian revolution of 1917, a new wave of changes swept through these lands, and with it the new mathematics brought by the refugees from the Czarist Russia. Many mathematicians that fled from the Russian revolution towards the west, stopped and settled in the Balkans. The first translation into Yugoslavian languages, for example, came through this route.[22] By the end of the Second World War the division of Europe into Western and Eastern Blocs meant further changes to the mathematical cultures of the Balkan societies, and the changes are yet to pan into the new stories for the new generations.

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22 See Lawrence (2008).

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**Математичко образовање на Балкану до Првог светског рата**

Иако је цео свет захвалан Грцима за њихову геометрију и исламским математичарима за њихов рад на развоју алгебре, историја ратова и насиља на Балканском полуострву значила је да ниједна од ових двеју великих култура математике није преживела после 19. века. Овај рад заснива се на истраживању веза у историји математике на Балкану и ограничен је на разјашњење историје и развоја културе у три балканска друштва: грчком, отоманском и српском, а завршава се догађајима у раном 20. веку. Овим радом покушаће да се опише и покаже како су ове три културе математичког образовања концептуализоване и како је њихов развој био под утицајем математичких култура западне Европе. Описаћемо системе школа и универзитета, прве професоре математике на универзитетима у ова три друштва, као и њихове програме математике и неке од првих уџбеника математике.

Прва математичка култура коју описујемо у раду јесте отоманска, и то са позиције развоја њеног друштва и државе, те војног уређења и, наравно, математике, којом се бавимо у поменутом контексту. Отоманска царевина (1299–1922), на врху власти у 16. и 17. веку, ширила се на три континента, од југоисточне Европе до северне Африке и Блиског истока и обухватала је територије од Гибралтара до Персијског залива и од модерне Аустрије до Судана и Јемена. Отомани су развили систем школа – медресе, које су осниване од 9. века широм муслиманског света. У медресама су се, осим проучавања религиозних научних дисциплина, проучавале и дисциплине посвећене рационалним наукама, као што су арапски језик, логика, аритметика и етика. Рад прати развој отоманске математике у Царству, од медреса до првих универзитета, показујући утицај који су имали Французи и Енглези у успостављању школа у Царству, као и уџбенике који су се преводили са француског и енглеског језика и били коришћени у отоманским институцијама знања и учења.

Грчко математичко образовање, мада историјски вероватно има највећи утицај на развој математичког образовања у европском и западном свету, није имало континуитет на грчком подручју, које би повезало старогрчко и модерно грчко математичко образовање и културу. Грци су се, после колапса Римске царевине, нашли под отоманском владавином, која је трајала столећима. У раду пратимо како су Грци успели поново да успоставе своју интелектуалну и математичку културу кроз специфичност њиховог статуса под Отоманима. Наиме, Грци су били познати као највећа ортодоксна етничка група у Отоманском царству, и као такви имали су посебне привилегије и приступ владајућим Отоманима. Неколико примера који се могу пратити кроз историју модерне грчке математике показују утицаје под којима су се нашли на прагу свог ослобођења од отоманске владавине.

Посебна снага грчке културе у овом периоду била је њихова дијаспора. На пример, Вулгарис (Evgenios Voulgaris) завршио је универзитет у Венецији и Падови, што су му омогућила браћа из дијаспоре, Ламброс и Симон Марутсис (Lambros and Simon Maroutsis). Вулгарис се усредсредио да поврати својој домовини нешто од старе грчке математичке културе верујући да је грчка геометрија основа за било који будући напредак у математичком образовању.

Рад даље прати развој грчког математичког образовања, показујући нам да су француски, енглески и немачки утицаји били преовлађујујући у успостављању модерне грчке математичке културе и образовања.

Српска математика, мада релативно млада, од посебног је интереса за рад, не само зато што се наш рад налази у публикацији која потиче из Србије него и због специфичности релативно мале културе која је произвела важну и утицајну математику и математичку културу и произвела веома угледне математичаре у релативно кратком времену. Српска математика развијала се под утицајем Отомана, а после 1833. године под утицајем Аустроугарске монархије. Прва књига о математици на српском језику штампана је тек 1737. године, а студије математике на вишем нивоу настају тек 1838. године (Лицеј).

И поред тако касног почетка, на крају 19. века Србија је већ имала неколико добрих математичара на докторским студијама у Паризу, Бечу, Берлину и Будимпешти. Најпознатији од њих био је Михаило Петровић, звани Алас, који је у Паризу направио неколико важних контаката и веза са математичарима и политичарима, што је омогућило српској математичкој култури приступ важним скуповима, од којих је један била Интернационална конференција математичког образовања одржана у Паризу априла 1914. године, када је српска делегација дала извештај у коме је саопштила да је краткорочна историја некад погодна за напредак математике:

„Код оних нација које тек почињу свој напредак, без основа традиције, генерално идеје, а специјално нове идеје, могу постати важан идеал за нове генерације...“ (L›Enseignement Mathématique, 16 (1914), 332–333).

Историја српског математичког образовања и културе завршница је овог поглавља.

***Кључне речи:*** математичко образовање у 19. веку, математика на Балкану, грчка математика, отоманска математика, српска математика.