MATHEMATICS AND ASTRONOMY IN THE EDUCATIONAL SYSTEM OF SERBIA IN THE SECOND HALF OF THE 19TH CENTURY

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Abstract. In the second half of the 19th century solid fundaments of the educational system were formed in Serbia, in order to follow the contemporaneous development in Europe. Mathematics and astronomy found an important place in this educational system thanks to, above all, distinguished intellectuals who were pioneers in the improvement of education and science in these fields, such as Dimitrije Nešić, Dimitrije Danić, Bogdan Gavrilović and Mihailo Petrović in mathematics and Milan Nedeljković, Milan Andonović, Jovan Dragašević and Djordje Stanojević in astronomy.

1. INTRODUCTION

The educational system of Serbia during the second half of the 19th century was characterized by a tendency towards changes and reorganization in order to follow more quickly the contemporaneous knowledge and achievements of the world science, especially those from Europe. Till that time education had been mostly directed towards the increase of the cultural level of the people, while later it got a new orientation characterized by an interest in natural sciences, when their importance for a faster society development had been realized. Numerous articles and printed versions of speeches appeared (especially in journals "Nastavnik" and "Prosvetni glasnik") in which the importance of natural sciences for education was emphasized, where astronomy and mathematics achieved a special affirmation.

2. TEACHING OF MATHEMATICS

The movement requiring a reformation in teaching of mathematics appeared firstly in Europe with a book entitled "New Elements" by Ch. Merey which appeared in 1874 in France (Tipa 1920) to reach new lands later on. Till the seventies of the 19th century mathematics in Serbia was taught on an elementary level. The position of Atanasije Nikolić, who wrote the first textbook on algebra, was that the work on a mathematical dictionary should precede any change of teaching of mathematics (Trifunović 1977). When Dimitrije Nešić (1836 - 1904) became a teacher at the Lyceum and afterwards at the Grand School, he also started an initiative to reform and make

teaching of mathematics up-to-date. For instance, one of the novelties introduced by Nešić was to encourage the students, during the time spent at the Grand School, in research activity including writing papers as well. Also, the teaching at the Mathematics Department, where he was the only teacher, due to his endeavor was divided into advanced courses, where Nešić continued his activity, and non-advanced ones. Nešić, being also the first to start a serious research in mathematics, appeared as a "dawn" of Serbian mathematics as said by Trifunović (1996) (as for Nešić, see also Jovanović, Petković 1998). In addition to his activity an important contribution also belongs to the first PhD owners in mathematics: Dimitrije Danić (1862-1932), Bogdan Gavrilović (1864-1947), Djordje Petković (PhD in mathematics in 1893), Mihailo Petrović (1868-1943), Petar L. Vukićević (1862-1941). Dimitrije Danić was the first to obtain the PhD, in March 1885 at the University of Jena (*Conform mapping of elliptical paraboloid onto a plane*). As a teacher at the Military Academy in Belgrade he wrote a few good textbooks and was also active in the research (Kečkić 1998; Vućićević 1998). Bogdan Gavrilović became a teacher at the Grand School in 1887 and his responsibility was the teaching of non-advanced mathematics. Together with Nešić he was intensively engaged in the reform of the Grand School and its rising to a university level (Mijajlović 1997). Petar L. Vukićević 's creativity path in mathematics was much influenced by the fact that the teacher position at the Faculty of Philosophy of the Grand School opened on June 21, 1894 was given to Mihailo Petrović exceeding him by only one vote. Some time he spent working as a secretary in the Ministry of Education. He wrote a few mathematical textbooks for secondary schools and published several articles (Trifunović, Perišić 1996). The quality of teaching of mathematics was especially improved when Mihailo Petrović began to teach at the Grand School. He introduced new principles in its activity and managed to put this science to the contemporaneous European level. Being a versatile personality he is one of the most fruitful scientists in Serbia in the late 19th century and in the first decades of the 20th century. His most important contributions are in the field of mathematical phenomenology and he attracted a great heed by his patents of analogous calculators, especially by his hydrointegrator from 1897 (Trifunović 1967, 1969, 1977; Kečkić 1997).

3. TEACHING OF ASTRONOMY

The most important contribution in improving teaching of astronomy and affirmation of astronomical science in the second half of the 19th century in Serbia was given by: Milan Nedeljković (1857-1950), who taught at the Grand School and is the founder of the Astronomical and Meteorological Observatory and its first director (Opra 1998); Milan Andonović (1849-1926), engineer who taught geodesy at the Grand School and founded the private Academy of Geodesy and Civil Engineering (Trajkovska, Protitch-Benishek 1998); Jovan Dragašević (1836 - 1915), who taught at the Military Academy, was a writer and geographer, a colonel in the General Staff; and Djordje Stanojević (1858-1921) who was engaged at the Military Academy and taught physics at the Grand School (Trifunović 1997). From the middle of the 19th century astronomy was taught in the framework of various subjects: in the primary schools elementary astronomical notions were taught in the framework of mathematical and physical geographies; in gymnasiums and secondary schools the programme foresaw astronomy with mathematical geography and meteorology at first as part of physics course,

Figure 1: The document from 1892 belonging to the Archives of Serbia: Examination marks of Astronomy and Meteorology for the students at the Faculty of Philosophy (Department of natural sciences and mathematics)

whereas in the reformed Law of Gymnasium Organization of December 12, 1873 it was proposed to teach cosmography together with geography which, from 1884 based on a decision of the Education Council of the Ministry of Education and Church Affairs, were studied separately till 1898 when a basic course of astronomy belonged to physics; in the High Female School mathematical geography and physical one were taught from 1866 and from 1879 cosmography was taught with physics. Astronomical topics were also widely present at the Military Academy, where cosmography was a special subject, at the Faculty of Engineering they were taught in the framework of meteorology and geodesy, whereas at the Faculty of Philosophy there was a subject named Astronomy and Meteorology taught during the fourth year of studies at the Department of Mathematics and Natural Sciences.

The books "Cosmography" by Andonović and "Cosmometry" by Dragašević were used as astronomy textbooks at the Grand School and Military Academy, respectively. They had exceptional concepts containing actual astronomical topics, with

many figures and tables, which made it possible to achieve a higher quality of teaching (Trajkovska 2000). In the present paper as an illustration how an examination from that period looked like, the author gives a document from the Archives (AS, VŠ, No 852/1892) corresponding to the examination performed by Milan Nedeljković and which contains the marks for Astronomy and Meteorology (Fig. 1). In this document one finds, among others, the names of Jelenko Mihajlović (1869-1956), the founder of the Seismological Observatory and of Maksim Trpković (1864-1924) who did a project of calendar reform in 1900 adopted with some changes proposed by Milutin Milanković (1879-1958) at the Pan-Orthodox Congress in Constantinople in 1923 (Trajkovska 2003). In addition to their speeches and articles on the importance of astronomy, Nedeljković, Andonović and Stanojević, as members of the Main Education Council where important questions concerning education were solved, played crucial roles in obtaining a more important place for astronomy in the educational system. This is a period when astronomy had a renaissance (Trajkovska et al. 2002).

4. CONCLUSION

In their pioneering work to reform teaching of mathematics and astronomy and make it more up-to-date in the second half of the 19th century in Serbia, many distinguished intellectuals with a sincere enthusiasm invested a lot of their energy to transfer their knowledge, especially that acquired in the European centres of education, into a midst like Serbia of that time. They, in theirs general striving, did many efforts to take the step with the achievements in science in technology of more developed Europe.

Acknowledgements

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