Comparative study educational legislation

Within the project, a series of discussions were held regarding the legislative side after which the education in the two neighboring countries is carried out.

There have been a number of similarities in the teaching of mathematics, science and technology:

- in each case the school programs are developed on school subjects; there is no provision in the compulsory curriculum for interdisciplinary science teaching;

- each subject is taught according to a program where the chapters / themes are provided, the number of hours

- each subject is taught by a specialized teacher; teachers are specialized for a single subject;

- PISA evaluations were applied in both countries from which a number of conclusions were drawn;

- there is no possibility of learning through the educational project method during the compulsory class hours.

The differences between the two educational systems in the field of mathematics, science and technology:

- in the Romanian syllabus there are provided optional hours (Curriculum at the disposal of the School) which does not exist in the Bulgarian curriculum,
- In Bulgaria, a new education law is being prepared which will bring about essential changes,
- The forums responsible for education in Romania were not sensitive to the results of the PISA assessments; the measures taken were not in accordance with the conclusions drawn.

We will analyze the results of the PISA tests in the two countries and integrate the MICS (MaST Innovation and Creativity Study Shops) strategies into the educational framework existing in each of the two countries.

Bulgaria

NATURAL SCIENCES, MATHEMATICS, INFORMATICS AND INFORMATION TECHNOLOGY

Natural Sciences and technologies in the school of XXI century are the focus of the latest researches of the Programme for International Student Assessment /PISA /.

In the conceptual frame of PISA literacy in Natural Sciences is defined as the ability of the student to get engaged consciously and responsibly with questions from the field of Natural Science by showing:

*knowledge in the field of Natural Sciences and the skills to use them for acquiring new knowledge; for describing natural processes and occurrences; for making argued conclusions;

*understanding of the basic characteristics of natural sciences as part of the cognition about the world;

*awareness about how natural Science and technologies affect the material and the spiritual life of the society;

*readiness for active civil behavior on problems from the field of Natural Sciences.

PISA defines three competencies, which are directly connected with Natural Sciences, whose assessment gives us information about the level of Natural Sciences literacy of the students: *defining scientifically natural processes and occurrences; planning and evaluating scientific research; scientific interpretation of data and facts*. The way in which the three competencies are formulated shows that accent has been put on the research approach. The central place of the competencies in the definition of Natural Sciences literacy reflects the understanding that the research approach mainly consists of gathering data, formulating hypotheses, carrying out research and verifying the results and the conclusions.

/PISA is a long-term project of OECD for making indicators for the quality of education, the beginning of which is in 1997. The aim of the project is to research the processes in education by evaluating the achievements of students in three fundamental cognitive fields according to a common international framework – literary, mathematical and Natural Sciences literacy /

PISA's approach is a challenge to the model of Natural Sciences teaching in a number of countries, including Bulgaria, where knowledge of the nature predominates, whereas methodological knowledge is relatively less covered. Precisely the competency of *planning and evaluating scientific research* is the most directly connected with knowing and using the research approach. A student has formed this competency when he knows and applies the general procedures, typical for scientific research, and understands the role of these procedures for arguing the derived conclusions. Consequently, countries, in which students show relatively low results in this competency, must concentrate their efforts towards forming deeper methodological knowledge and skills for carrying out experiments and analysis on empirical data. The results of Bulgarian students point the attention towards the structure and contents of curricula for Natural Sciences, Mathematics and Information technology.

All curricula in Bulgarian schools are pointed towards reaching the state educational standard for general education.
It is an aggregation of requirements for the results from the schooling of every general education subject, in the end of every stage of the corresponding stage of education and determines:
1. The aims, contents and characteristics of general education;
2. The general education school subjects;
3. The requirements for the results from the schooling of every general education subject
for acquiring general education background.

Education is carried out in two stages – the first stage consists of two levels: primary and lower secondary level; the secondary stage consists of two levels - first and second high school level.
The general knowledge background is acquired in the course of the whole school education and encompasses different groups of key competencies, which are specified as expected results.
They are interrelated and represent an aggregation of knowledge, skills and attitudes, necessary for the personal development of the individual during his whole life, the forming of active civil position and participation in social life as well as his suitability for realization in the labor market.

In the second high school level of secondary education students acquire their profiling, which encompasses thorough and complex competencies for a specific profile.

The cultural-educational field "Natural Sciences and Ecology" ensures the forming of a system of knowledge, skills and their included attitudes, connected with nature. This way, in the consciousness of the students is formed an idea for the integrity of nature and its diversity.
A significant part of the cultural-educational field is connected with the formation of knowledge, skills and especially attitudes, relating to ecology, conservation of the environment, preservation of health, tolerance towards all that lives, which are a mandatory part of the education of the modern person. This way, the field contributes to the provision of full development of the students and the preparation for their future life and professional realization.

In the different classes and educational stages the student acquires knowledge and skills and the connected with them attitudes for:
- describing, recognizing and grouping organisms, materials, substances,
natural occurrences and processes, while gradually mastering he necessary terminology;
- tracing the interaction, change and development of natural objects;
- using primary (contemplation, experiments) and secondary (schemes, graphs,
models, etc.) sources of information for objects, processes and occurrences in living and nonliving nature;
- practical work with devices, machines, substances, mixtures and natural objects;
- determining and analyzing (depending on the age capabilities) of internal connections between the processes in nature;
- applying the mastered laws when solving specific practical tasks;
- using research methods in solving problems in different areas of life;
- forming ecological culture and determination to preserve the environment;
- orientation towards higher personal achievements in gathering knowledge about nature, readiness for sharing the acquired knowledge and skills.

The school subject Biology and Health Education includes knowledge about the structure, processes, hierarchical organization of living systems and their evolution. It ensures the formation of skills for orientation in the diversity of organic life, application of the knowledge about life, rules for a healthy lifestyle and norms for behavior in the natural environment. Knowledge and skills, developed during the education in Physics, Chemistry, Geography and Informatics, are used.
The subject Chemistry and Environmental Protection studies the properties and conversion of substances, their distribution, their obtaining and effect on the environment. Forming practical skills when working with substances is an important part. When studying the substances, their physical characteristics and regularities are widely used. On the other hand, when studying the applications of the substances, attention is paid to their importance for living organisms. This way, the connection and unity of the separate subjects in the cultural-educational field is. This connection is used exceptionally when reviewing questions which are connected with protecting the environment, a theme, in which Biology and Physics have importance comparable to that of Chemistry. The subject Chemistry and Environmental Protection allows the students to receive knowledge about the complexity and volatility of substances, the methods for researching and the fundamental laws, on which these changes rest.

The subjects Mathematics, Informatics and Information Technology lay the foundations of a methodology, which has an application in all fields of general education. Via the education in these subjects, the students prepare to handle information.
Mathematics deals with research in the quantitative characteristics of objects and occurrences from all over the world. It presents adequate mathematical models for solving the tasks, related to these quantitative characteristics, using well-specified procedures (algorithms).
The accumulation of such characteristics (information) is so big that their storage in formalized type (data) and using them would be impossible without the aid of technical resources (computer systems).
The procedures for processing data are so complex that their application is possible only with the aid of computer programmes.

The mathematical knowledge and skills are important for all other subjects taught at school. They help the students to better understand the modern informational society and to adapt to it.

The objects of Informatics are the methods and means for accumulating, storing, processing and transferring data.
Informatics produces computer variants of the mathematical models of the objects and occurrences.
Via Information Technology, methods and means for presenting, analysis, interpretation and transfer of data, which are available for mass use, are created.
The school subjects complement each other and are in close interconnection.

The preparation of the students in these subjects is achieved via a different number of classes, included under different forms, in the curriculum of each school.

The quantitative difference in the number of classes for preparation of the students leads to qualitative differences in the level of gathered knowledge and skills, the formed competencies and opportunities for realization of the students. This difference can also be observed in the quantity of classes, provided in the curriculums of the schools, participating in the project. /Application – table/.

Subject	Content in SECONDARY EDUCATION, Grammar School	Class / number of hours	Veliko Tarnovo	Silistra	Tutrakan
Biologie	Biosphere (macrosystem, structure and processes). Cell (microsystem and processes Multicellular organism (mesosystem - structure and processes) Biological evolution.	VIII IX X XI XII		- 72 72 72 -	--------- 72+72 72+72 108 124

Chemistry	Classification of substances and Nomenclature. Construction and properties of substances. Application of substances. Chemical processes. Experiment and research.	VIII IX X XI XII		- 54 72 72 ---	------ 72 72 72 31
Mathematics	Numbers. Figures and bodies. Functions. Measurement. Logical knowledge. Probabilities and statistics. Modeling.	VIII IX X XI XII		108 108 108 72 62	-------- 108 108 72 62

Informatics	Information and formal models. Computer Systems. Operating Systems. Algorithms and data structures. Programming. IT in problem solving. Communication through IT. Object control and management. Integrating IT activities. Modeling.	VIII IX X XI XII		36 36 36 - -	---------- 72 36 36+72 62

România

The used material is taken from the Transilvanian Magazine of Administrative Sciences 2 (39) / 2016, pp. 40-55, authors Simona Claudia Crețа and Sorin Dan Șandor and CNEE PISA Report.

Matematică.
On the whole, in mathematics Romania experienced an increase between 2006 and 2012, especially by reducing the percentage of students at level 1 and increasing the number of students
which have had very good results. In 2006 the score obtained by Romania in mathematics was 415, lower than in 2000 (426), but with a slight increase in the following years 427 (2009) and 445 (2012), followed by a insignificant decrease to 444 (2015).

The states that achieved similar scores to Romania in 2006 were Thailand (417), Bulgaria (413), Chile (411), in 2009 Azerbaijan (431), Bulgaria (428), Uruguay (427) and again Chile (421), and in 2012 Serbia (449), Turkey (448), Cyprus (440) and Bulgaria (439). In terms of gender distribution, in this area boys' results outperform those of girls, but the differences are not major.

As for the scores obtained by the Romanian students by levels - in 2006 the majority were positioned at level 1, in 2012 40.8% of the Romanian students reached only level 1 compared to the 23.1% OECD average, of these 14.8% is below this level. More serious is that only 3.2% achieved very good results (OECD average being 12.6%), only 0.6% reaching level 6 (National Center for Evaluation and Examination, PISA National Center, 2014, p. 16).

Științe.
Even in this area the results of the Romanian students were not at expectations level, the scores obtained being well below the OECD average. If in 2006 the states with similar results to Romania in the field of sciences were Turkey (424), Jordan (422), Thailand (421), Montenegro (412) and Mexico (410), in 2009 they were Bulgaria (439), Uruguay (427) and Thailand (425), and in 2012 Bulgaria (446), Chile and Serbia (445), Thailand (444) and Cyprus (438).

It is noted that in all three areas, during the tests, Romania groups with Bulgaria, Turkey, Cyprus or South American states such as Chile and Uruguay. Thailand also belongs to this group. Regarding the distribution of the results by levels, in 2009 if in the OECD countries 8.5% were positioned at level 5 or 6, students from three states failed to reach these levels (Indonesia, Azerbaijan and Kyrgyzstan).

Only 0.4% of the Romanian students obtained scores corresponding to these levels and only 4.8% scores corresponding to level 4 (next to states such as Mexico, Albania, Colombia, Montenegro or Peru). Between 2006 and 2012 Romania was able to reduce the proportion of students who were below the second level but did not register an increase in the percentage of students with good results in science.

The test results from 2012 show us that 0.0% of Romanian students have reached level 6 and only 0.9% level 5; most are at level 2 (34.6%), a position similar to the average of all participating states, 26% of the students tested in science that year obtaining scores at this level (National Center for Evaluation and Examination, PISA National Center, 2014, pp. 21-22). However, as a whole, the Romanian students have managed to constantly improve their performance in science from 2006 to 2012, after which in 2015 there was a slight decrease.

Interestingly, the overall average for each of the three domains, although regressed in 2006, improved in subsequent tests. The results of PISA 2015 show us that Romania maintained its scores compared to 2012; although they registered a slight decrease, the difference between the scores obtained by the Romanian students and the OECD averages diminished. On the other hand, the proportion of students who achieved performance in at least one of the three areas is 4.3%, well below the

OECD average (15.3%), but slightly better than in previous tests. The proportion of students who scored below the second level in all tests is 24.3% with 11.3% above the OECD average.

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Use of PISA results and successful cases in the debate on education policies

The reactions were initially quite mixed - in the absence of other data, the discussion about the quality of Romanian education was based on the number of medals obtained at the International Olympics (mainly the mathematics one). The PISA results indicated that, beyond the peaks, the situation of education in Romania was very poor. Many of the initial reactions, especially from the teachers, were to deny the quality of the test - the PISA subjects were not considered relevant because they seemed too simple compared to the kind of problems that Romanian students were used to in class.
For an education based on the accumulation of knowledge the idea that they do not translate into basic competences was quite difficult to assimilate. However, under the influence of the European Union, the educational objectives were changed. If the goals Education Law no. 84/1995 referred to the acquisition of knowledge, the last law of education, Law no. 1/2011, refers to the acquisition of skills.

The poor results of the PISA tests were read in several keys, and the comparison with the pre-1989 education, considered to be superior, was one of them.
Such a comparison is, however, difficult to make because there is no comparable data on the state of education prior to 1989.

Presenting these results without too much many comments is another possibility. Apostle et al. (2015) in a dedicated work data-based educational policies present the results of PISA tests in a chapter entitled "Basic Skills". The presentation highlights Romania's poor ranking in Europe, but also mentions the slight improvement in the last tests (2009 and 2012). Theory Kingdon (1995) tells us that an external shock can generate a window of opportunity for adopting a new policy, but poor results in PISA testing can be used as such a shock, paving the way for the promotion of new policies. In some countries PISA results provided rhetorical arguments for promoting reforms (Baird et al., 2011, p. 2) - there were also reforms in Romania, being promoted, without necessarily having to do with the results of the students.