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Educational policies in natural science training

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Abstract: *The educational policies are considered as one of the ways to overcome the problems faced by the educational system in the Bulgarian universities, in particular those related to the natural science training. The research explores the essence of the modern educational policies in natural science training and the identification of its features.*

Keywords: Educational policies, Science training in Universities

Introduction

There are many indicators that point to the need to analyze educational policies in the field of higher education and the closely related to it, secondary school education. They are particularly eloquent regarding the natural sciences, which, due to their integral nature, generate additional difficulties in the education.

A significant part of the indicators results from the common problematic areas faced by the educational system in the Bulgarian Universities. Those problematic areas can be classified into three groups: (Fig.1).
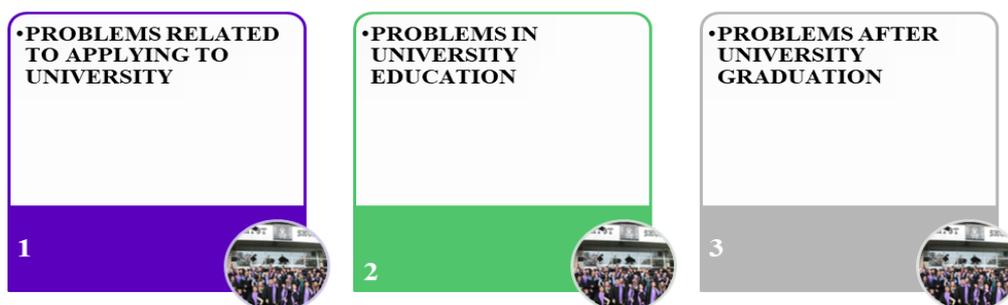

Figure 1. Main groups of problems in universities

The problematic areas mentioned above do not cover the whole range of problems, but only mark the main ones. To the problems from the first group (problems arising when applying to a university) can be attributed:

- Reducing of the number of prospective students due to severe demographic problems.

- The existence of social problems, such as lack of financial resources, that do not allow minority groups to continue their education in University, after completing their education in secondary school. Because of these problems they need to start working.

- Lack of effective connection between the development of higher education and the constantly changing needs in the different regions of the country.

- An uneven territorial structure of the Universities in the country leading to higher educational costs for the students with minimal social resources.

As part of the problems of the second group (problems arising in higher education) can be mentioned:

- Lack of motivation of young teachers and aging of the academic staff.

- Insufficient outgoing and low incoming mobility of students and teachers, which leads to a formal implementation of the Credit Accumulation and Transfer System.

- Poor practical training of students in real working environment. This leads to lack of adequate practical competencies.

- Insufficient flexibility in creating opportunities and forms of learning, as well as lack of innovation in the programs that are tailored to the learners' age.

The main problems of the third group (problems arising after the graduation of university), are related to:

- Insufficient job vacancies for professional realization in the studied specialty due to the increase of the working age, etc.

- Requirement from the employers of a certain experience in the specialty which cannot be acquired while the students are still studying in the University.

- Lack of balance on the labor market. There is a shortage of specialists in the field of engineering, natural and pedagogical sciences and at the same time an excess of specialists in other fields.

These problematic areas are a reflection of the global socio-economic trends in the world, Europe and Bulgaria and form a significant potential for challenges to their educational policies.

The purpose of this research is to specify the essence and the features of modern educational policies in natural science training in the Bulgarian Universities in order to overcome some of the currently existing problems.

Materials and methods

The following methods are used in order to study the regulatory framework of the European educational policies: content analysis and comparative analysis.

An analysis of pedagogical, psychological and methodological literature is made in order to identify the current trends in the educational policies in science training in the universities.

Results and discussion

The educational policy is an integral part of the policy of each country, and in particular of its social function. Its main purpose is to provide education and training to future members of the cohesive community. The activities related to the implementation of the state educational policy are demonstrated by the practical implementation of the right to education, by the introduction and the maintenance of an effective and quality primary, secondary and higher education.

The meaning of the word „politics" is subject to various justifications and is widely applied in all areas of life. This is also the case with the concept of „educational policy", which is also subject to a wide range of opinions.

One of the broadest definitions in Russian literature defines it as „a guiding and regulating activity of the state in the field of education, which purpose is to achieve specific strategic objectives and solutions of tasks of national and global importance" [1].

In English literature, the educational policy is associated with „the elaboration of a system of laws and rules that govern the functioning of the educational system" [4] and also „with programs prepared by

the government that outline the main purposes and highlight the main directions of development of the educational system" [3].

According to one of the definitions used in the Bulgarian pedagogical literature, „educational policy is regarded as a complete system of objectives, specific organization, management and development of the educational process" [2]. At the same time, the educational policy decides on the objectives and the priorities of education, on the mechanisms necessary for their implementation and the overall vision and state of the educational system [7].

Based on the author's opinion on the essence of the educational policy, certain features can be identified which combine its characteristics (Fig.2).
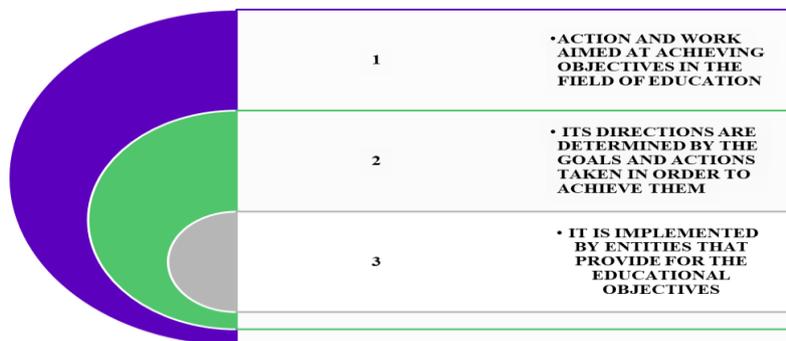

Figure 2. Main characteristics of the educational politics [6]

From all the aforementioned definitions, which do not exhaust their diversity, we come to the conclusion that the educational policy is an integral part of the state's social function. In Bulgaria, it is regulated by the Pre-school and School Education Act, the Vocational Education and Training Act, the Higher Education Act and a number of regulations, in some of which are also specified the State Educational Standards which govern the Issues of School Education [5].

The Educational policy is a complex phenomenon consisting of several integral parts represented by the directions of the different educational policies depending on their purpose, subject and expected result (Fig. 2). All educational policies have a cyclical nature which binds the individual objects/subjects involved as well as the purpose and the expected outcomes. The achievement of the goals set by the educational policies is based on specific decisions that should lead to certain actions characterized by their effectiveness in terms of end results and closely related to the intended objective.

The educational policies can be distinguished by the areas of manifestation, the scale of expected outcomes, the time of implementation, and by the degree of effectiveness in resolving the occurring problems.

There is a certain hierarchy and subordination between the different educational policies.

The global policies in the field of education and training determine those of the European Union which from their side are projected into the educational policies in Bulgaria.
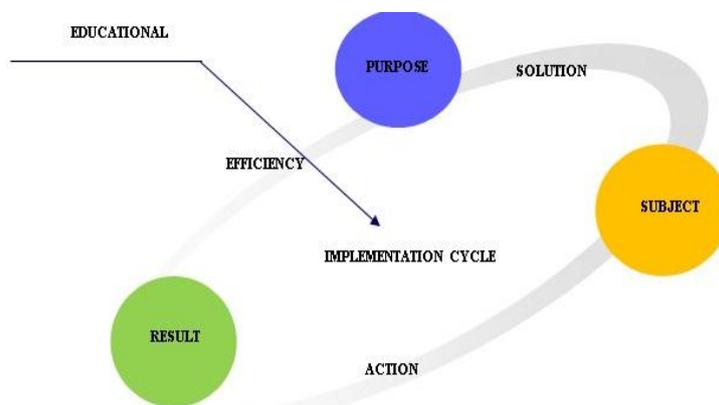

Figure 3. Cycle of implementation of the educational policies

The educational policies in the field of natural sciences in Bulgaria are closely related to those of the European Union which are not mandatory. Nevertheless, there is a common desire between the Member States to synchronize their education systems towards the internationalization and the adoption of education as a key priority.

Today, *the educational policies at EU level* seek to address the main issues of education in the context of the contemporary cultural situations as well as the trends, the orientations and the opportunities in the educational policies of individual Member States. At the same time, a promotion and an encouragement of pan-European dialogue is being sought between the governing bodies, teaching staff, parents and non-governmental organizations through the exchange of information and the dissemination of new ideas and examples for successful practice.

If we go back to the 1970s and 1990s, we will see what a long way has been passed in the development of European educational policies from the initial attempts of pan-European focus to this day. From the beginning, when education was a self-regulatory area and the EU only coordinated and supported this process to today when there is a desire and an opportunity for synchronization of national educational policies.

The new perspectives regarding the European education policies are indicated in the "Europe 2020" Strategy, which is based on the priorities set out in Figure 4. They are confined to a smart growth linked to building of knowledge and innovation based economy; a sustainable growth for the promotion of a more resource efficient, greener and more competitive economy and an inclusive growth fostering a high-employment economy delivering a social and territorial cohesion [8].
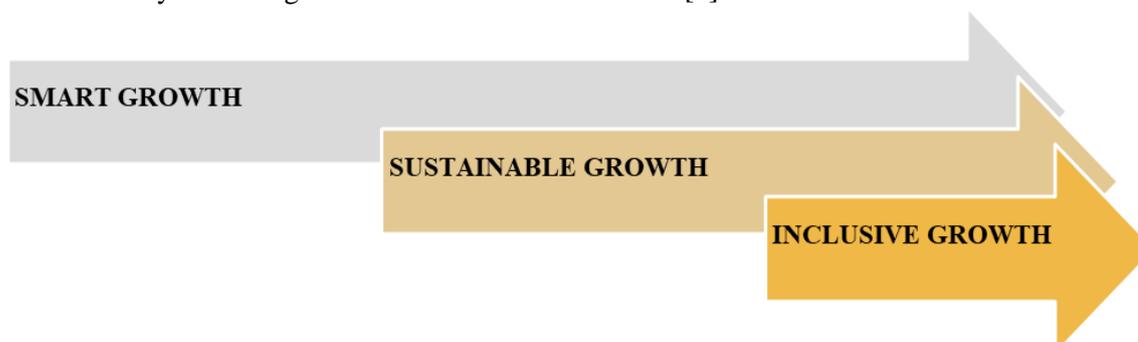
Figure 4. Priorities of Europe's educational policies according to the Europe 2020 Strategy

It is clear that the Common Strategic Framework for Education by 2020 emphasizes on the inclusive learning approaches. Through them it is planned to provide equal opportunities to young people coming from the most diverse cultural, religious, racial, social and minority communities and with different educational needs in order to be able to develop their potential. These principles of equality and diversity are also emphasized in the measures aiming at opening up education, which should not only encourage creative learning environments but will also raise awareness of the representatives of different cultures and their specific ways of expression.

A proof of this is also the Common Framework for Key Competencies, which unifies for all member states the set of the most important competences needed for personal development, professional and career development and active European citizenship.

Over the past decade, the EU's policy and instrumental framework, which defines educational policies in the field of school education, is explicitly set as a value-based educational framework of tolerance, national diversity and intercultural understanding for introduction into the European social model.

At the same time, there is a lack of centralized EU policy in the educational sector, which is regulated and is explained by the priorities of European education. It develops the strategic, instrumental and coordinating framework that is accepted as a form of expression of the national, ethnic, cultural and religious diversity in the specific curriculum in the individual countries. The acceptance of this direction of the educational policies is imposed by the nature of the principles of multiculturalism and tolerance and their non-violation.

All European Commission flagship initiatives have an impact on the educational policies at the current stage, but four of them are directly relevant (Figure 5).

Figure 5. Leading initiatives of the European Commission of the European Union

This includes initiatives related to:

„Innovation Union" which main purpose is to improve the framework conditions and the access to financing for research and innovation so as to ensure that innovative ideas can be turned into products and services that create growth and jobs.

„Youth on the move" which purpose is to enhance the performance of the educational systems and to facilitate the entry of young people to the labour market.

„A digital agenda for Europe" which purpose is to speed up the roll-out of high-speed internet and to reap the benefits of a digital single market for households and firms.

„An agenda for new skills and jobs" which goal is to modernise labour markets and to make citizens more capable by developing their skills throughout their life with a view to increase labour participation and to better match labour supply and demand, including through labour mobility.

The Strategic Framework for European Educational Cooperation „Education and Training 2010" is a continuation of „Europe 2020" from „Education and Training 2020". The main priority areas are to promote mobility and lifelong learning, to enhance the quality and effectiveness of education and training, to promote equity, social cohesion and active citizenship, and to develop creativity and innovation at all levels of education and training [9].

In order to strengthen the connection between the ideas set out in Europe 2020 and Education 2020, the European Commission encourages and supports annual exchange of views between education and training stakeholders through a forum on education and training in which they discuss the progress in the modernization of educational and training systems. The work is also aimed at stimulating the development of EU member's educational systems by supporting national efforts through funding under various programs, including the new Erasmus + 2014-2020 integrated program.

The exchange of opinions, ideas and good experience in the sphere of education, including in natural sciences training, is stimulated by the expansion of the network for the European dimension of the education and collaboration between the countries in the online space through:

- The network of experts related to the social aspects of the education and training (NESET), which is specialized in creating researches for the encouragement of equality and including the education and training in the horizon of the EU [12];

- The network (Eurydice), which supports and facilitates the European collaboration in the field of education during our life by providing information about the educational systems and politics in 37 countries, and the opportunity to create researches related to common topics for the European educational systems [13];

- The online portal (eTwinning), which serve as a mean for collaboration and realization of different services, communication, exchange of ideas, specialized instruments and resources between teachers throughout whole Europe. The portal is accessible in 26 languages, including in Bulgarian, and offers different modules for mutual getting to know each other between the students from different nations, cultures and ethnic background, which work in a shared project [14];

- The European network (ENABLE) against bullying in learning environment and during leisure time, which aims to tackle bullying by helping young people to exercise their basic rights at home, at school, in class and in the community [15];

-The portal for scholar education (School Education Gateway), offering European educational politics, news, tendencies, national initiatives, activities for the schools, opportunities for collaboration between them, good practices for educational projects and additional resources [16].

In the field of the higher education the educational politics of the EU are directed to support the process from Bologna, to encourage a reform in the higher education for the establishment of the European space for higher education, as well as to encourage the exchange of good practices in the field of politics between the countries within the working group for higher education according to the strategy for education and training till the end of 2020.

The educational policies in the field of the natural sciences are an integral part not only of the educational policies of the EU, but also of the *state educational policies*. It is not by chance that one of the tasks related to the second strategic goal of the European Union Advisors conclusions from 2009 regarding the strategical framework for European collaboration in the field of education and training "ECET 2020" says: "Mathematics, natural sciences and technologies have to become interesting school subjects and areas for realization" [10].

Is it indeed like that?

If we consult the regulations and in particular art.77 of the Preschool and School Education Act we can find a definition of the key competencies that a student who have completed secondary education must have [10]. All of them can be formed while studying the natural sciences, and two of them are directly related to this education – mathematical competences and the basic competences in the field of the natural sciences and the technologies and skills to support sustainable development and a healthy lifestyle and sport.

The curriculum and state education standards arising from the Law on Pre-school and School Education are key regulations that regulate the changes in the secondary education. In this respect, they determine the state of natural science education and the directions for its future development. The main purpose of these courses is to have a quality natural-science training that meets European and worldwide standards. The key concepts it addresses are literacy, competences, lifelong learning, interactive learning, self-learning skills, interdisciplinary learning.

In practice, however, there are *serious problems* in science education in both secondary and higher education. The results of the international PISA survey, state matriculation examinations in physics, chemistry, biology and geography, as well as the reluctance of students to continue their education in natural sciences, are testified to. The statements about their results are due to the lack of competencies for processing and presenting data, solving problems in new situations, metacognitive skills for thinking and expression in scientific terms, for formulating scientific hypotheses in the mentioned areas.

All of them lead us to the main universal tendency about tuition related to natural sciences for creating natural-science literacy. Tafrova-Grigorova simplifies some common important characteristics about the term natural-science literacy, which is standing out of the crowd as a main goal and tendency about the training related to natural-sciences in the obligatory stage of the school education:

- understanding - of scientific concepts, principles and processes that helps to understand scientific and technological achievements, phenomena in living and non-living nature;

- evaluation - assessment of the benefits and damage from the achievements of science and technology, assessment of their impact on the environment and people's lives, their economic efficiency and their importance to society;

- application - skills to apply scientific knowledge and acquired competencies in real life situations, problem solving and acquiring new knowledge [11].

Still, the understanding, assessment and application of natural sciences and competences as basic characteristics of natural-science literacy not only for natural-science literacy pupils but also for students of natural science is of insufficient level.

One of the probable reasons can be found in the changes that have occurred in the *curriculum* and, in particular, in the distribution of class hours in school subjects and classes. In the last curriculum (ORDER № 4 of 30 November 2015 on the curriculum), the lessons in the natural cycle disciplines especially in the high school stage are sharply decreasing.

Table 1. Number of hours of school subjects in the field of natural sciences

School subject	8 grade	9 grade	10 grade	total
Geography and economics	36	36	90	162
Physics and astronomy	54	36	72	162
Chemistry and environmental protection	36	54	72	162
Biology and health education	54	36	72	162

According to the content of European documents digital literacy is one of the priorities of education, still the number of hours for studying of informatics and IT - 72 and 90 hours respectively is limited.

The comparison with other school subjects is more than indicative:
- History and civilizations 270 hours;
- Philosophy - 144 hours;
- Foreign language 1 – 998 hours;
- Foreign language 2 – 278 hours.

Another probable cause is *the lack of adequate material resources* needed for quality education in the natural sciences training. Regardless of the laboratory hours fixed in the curriculum, laboratory equipment in most schools is obsolete. The lack of laboratory equipment in small schools is another problem, which undoubtedly affects the ability to be formed experimental and research competencies.

The educational policies which stimulate *teachers* in secondary and tertiary schools are modestly represented as one of the most important resources in natural science training. Improving efficiency and access to training mostly depends on the provision of highly qualified, well-prepared and motivated staff. There is a considerable research and policy development of teachers education and development of their capabilities, as well as improving training conditions, but much less emphasis is placed on teachers motivation and the role of policies which provides a positive motivating environment.

Conclusions

From the analysis we can summarize that the European education policies of the EU do not get a complete projection on the national educational policy. The national educational policy makes it difficult to implement efficient policies in natural science training and is not actually implemented. Natural sciences do not fall into the spectrum of significant subjects as a relative share in secondary school curricula and are not the ones wanted to study in higher schools.

What *ways of overcoming the negative situation* can be proposed?

- Educational policies in natural science training must aim to form a stable educational base in secondary schools, to be further developed in higher education by increasing the hours of some school subjects such as physics and astronomy, chemistry and environmental protection, biology and health education and geography and economics.

The formation and development of natural science literacy should be a priority of educational policies in natural science training in secondary and higher education

- Educational policies in natural science training should stimulate the exchange of good international practices by motivating participation in international projects, helping to exchange ideas and experiences; fostering links, exchanging and creating new partnerships and networks; the publication of practical research and cooperation with other European institutions and non-governmental organizations.

The forms of the various activities for the realization of the educational policies in the natural sciences should be related to physical and virtual mobility, development of cooperation networks between universities, promotion of linguistic and cultural competence, development of innovation activities with the help of pilot projects, etc.

- Implementation of policies for research and stimulation of the motivation of teachers in secondary and higher schools in the field of natural sciences.

- Implementation of policies which improves working conditions and willingness to change, as well as priority financially stimulated courses of higher education in natural science education.

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