

Acta Pedagogica Naturalis

Former Annual of Konstantin Preslavsky University

Journal homepage: <http://acta-pedagogica.shu.bg>

Received: 20.12.2017

Accepted: 09.03.2018

Methodological aspects of teaching Natural sciences at Shumen University

Rositsa Vladeva, Petinka Galcheva

Shumen University, Faculty of Natural Sciences, Shumen, 115 Universitetska Str. Shumen, Bulgaria

E-mail: r.vladeva@shu.bg, p.galcheva@shu.bg

Abstract: *This study aims to analyze teaching Natural sciences at the Faculty of Natural Sciences at Konstantin Preslavsky University of Shumen” in the three educational degrees – bachelor, master, and doctor. The emphasis is on the methodological aspects of teaching in the bachelor pedagogical programs of Chemistry and environment preservation, Geography, and Biology. A survey among the students graduating these programs has been conducted to identify the problems related to their training for acquiring a pedagogical license and to overcome those problems.*

Keywords: *training, Natural sciences, pedagogical majors*

Introduction

In recent years, the quality of education at Bulgarian universities has been a current and discussed topic. Due to the dynamic changes and accelerated globalization of Bulgarian society, the educational system is expected to form adequate knowledge of contemporary economic and social development and to prepare competent, adaptable, innovative and motivated personnel. However, the reality does not always coincide with the expectations. There is a decline of applicants and a lack of motivation to study in the pedagogical programs of all sciences, including the natural sciences.

At the same time, in the European educational realm and in Bulgaria, the emphasis is on providing training and stimulating the development of pedagogical staff in order to realize the objectives of the EU 2020 Strategy [5].

The contradictions given are part of the reasoning for this research, and the rest are related to seeking answers to the questions:

- Why is there no interest in the teaching profession, since the school infrastructure is relatively evenly distributed by settlements?
- Why does science education prove to be one of the most complex in higher education institutions?
- How to build up the existing traditions in the field of science education with the modern educational trends so as to preserve and further develop the national identity in this field?

Materials and Methods

To study the legislative basis comprising the strategies and regulations the following methods are used: content analysis and comparative analysis.

In order to establish the contemporary trends in the educational realm of science education in higher schools, an analysis of pedagogical, psychological and methodological literature is carried out.

In order to take into account, the expectations of the students from the pedagogical disciplines, a survey is carried out with 58 students of Bachelor's programs of year 3 and 4 in the majors Pedagogy of Teaching of Geography and Biology, Pedagogy of Teaching Chemistry and Environmental Preservation and Masters of Geography and Interactive Education and Methodology of Teaching Chemistry and Environmental Preservation from the Faculty of Natural Sciences at the Shumen University. It is accompanied by the application of statistical methods for processing the results.

Results and Discussion

Some of the answers to the questions are closely related and derive from the *current state of higher education in this country and the problems in it*.

One of them is the unrealized academic autonomy of individual higher education institutions (HEIs) due to the fact that the state develops and conducts the policy in the field of higher education, it regulates the admission of students and regulates the financing of the respective HEIs in accordance with the state plans. In this way, HEIs cannot develop an adaptive profile of majors that meet the regional needs and at the same time be attractive to young people and beneficial for higher education institutions. This causes a lowering of the criteria for admission and reduction of the requirements to the students during their training in order to retain them and thus the realization of a poor quality educational product.

Another problem that reflects on the quality of HEI education is the aging of the teaching staff and hence the weaker motivation to constantly update the academic knowledge, to apply innovative methods of teaching and to take into account the novelties in the real production environment.

At the same time, higher education, including science education reflects the problems of secondary education which, in combination with the demographic crisis, are the cause people with relatively poor scientific background, insufficient activity and low initiative to enrol in universities.

Another factor that causes problems for the students who apply for studying in pedagogical majors is related to the large number of higher education institutions (11), which educate students in majors from the three professional fields of the higher education field „Pedagogical sciences“ (1.1. Theory and management of education, 1.2 Pedagogy and 1.3 Pedagogy of teaching...) for acquiring the Bachelor's and Master's degrees.

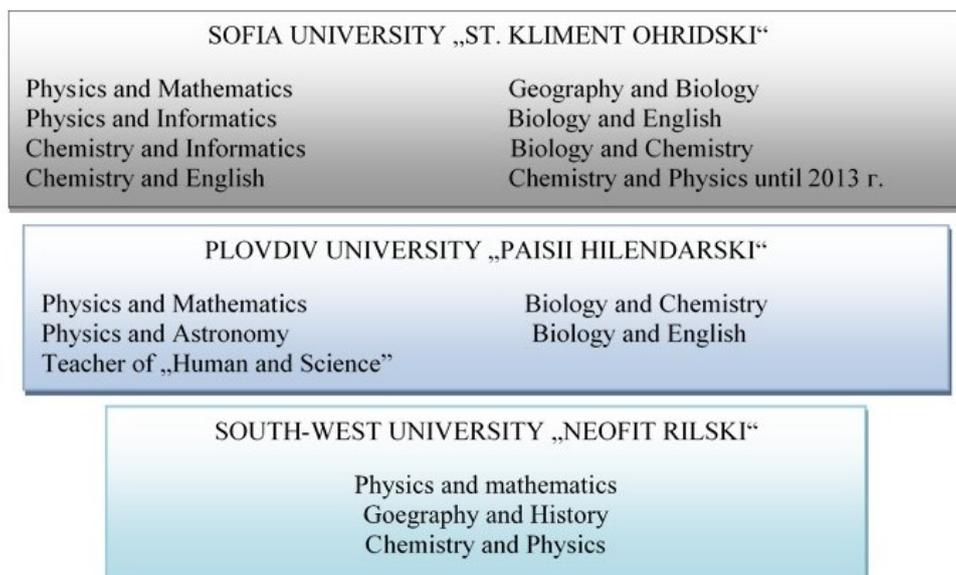


Figure 1. Universities and majors for pedagogical staff in natural sciences

In the field of higher education in natural sciences with a pedagogical profile, the competition is smaller and it is reduced to 4 HEIs with a spectrum of more than two specialties. These are Sofia University - 8 majors, Plovdiv University - 5 majors, Southwest University - 3 majors (Fig.1). In two more HEIs in Bulgaria there is a training of pedagogical staff in the field of natural sciences. Two specialties - history and geography and Bulgarian language and geography are taught in Veliko Tarnovo University, and in the Ruse University Branch in Silistra – one – physics and informatics.

In this territorial structure of universities, teaching pedagogical specialists in natural sciences, the Shumen University represented by the Faculty of Natural Sciences (FNS) occupies a suitable place. It is related to certain traditions, which are constantly built-up to provide such specialists for the north-eastern and eastern parts of the country.

The traditions are tied to the historical roots and mission of Shumen University and to the FNS. As a main structural unit for training, FNS is part of the Natural-Mathematical Faculty, established in 1971, of the Higher Pedagogical Institute in Shumen, which since 1964 has been a faculty branch of the Sofia University. Later in 1990, the scientific fields of the Faculty of Natural and Mathematical Sciences were transformed into independent faculties. Three of them – Physics, Chemistry, and Biology were united in the Faculty of Natural Sciences.

At present, students in the bachelor, master and doctoral degrees are trained in professional fields of the following higher education areas (Fig. 2). By the number of students, the faculty ranks second at the Shumen University. The total number of bachelor students in the faculty during the academic year of 2016-2017 is 756 and in the academic year 2017 – 2018 it is 652.

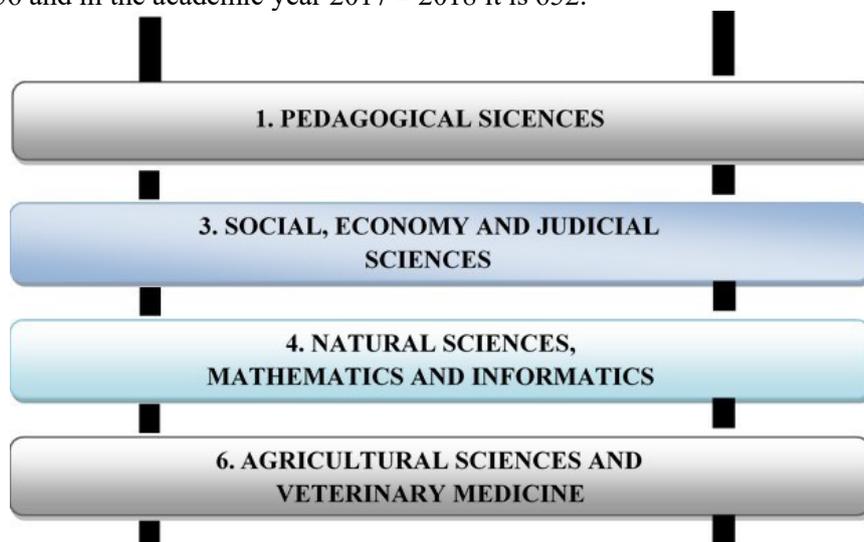


Figure 2. Training by fields of higher education at the FNS

Education in higher education field 3. Social, economic and legal sciences is realized in the professional field 3.9. Tourism for Bachelor’s degree in Tourism.

The most wide-ranging is the education in the field of higher education 4. Natural sciences, mathematics, and informatics. It is in the following professional fields:

- 4.1. Physical sciences;
- 4.2. Chemical Sciences;
- 4.3. Biological sciences;
- 4.4. Earth Sciences in the following majors and programs:
 - in the Bachelor’s degree – in majors – Medical Physics and Radioecology, Astronomy and Meteorology; Medical Chemistry, Ecology and Environmental Protection, Geography and Regional Policy;
 - Master’s degree – Master’s degree programs: Meteorology; Astrophysics; Medical Physics; Environmental biotechnology and food control; Chemical aspects of plant protection; Organic chemistry; Ecological Chemistry; Management and conservation of ecosystems; Ecology of microorganisms,

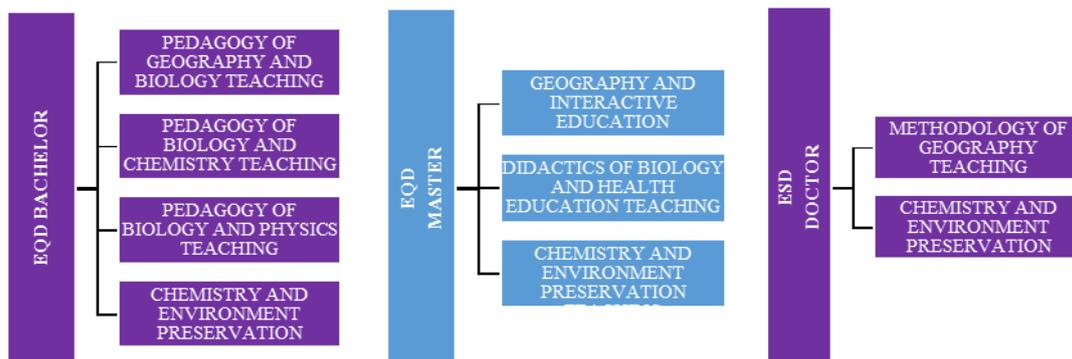
biotechnology, purification and control; Bioterrorism and food safety; Ecology of Medicinal Plants; Applied Geography and Geographic Information Systems;

- Doctor's degree – Doctoral Programs: Organic Chemistry, Astrophysics; Ecology and environmental protection.

Higher education field 6. Agricultural sciences and veterinary medicine is covered by professional field 6.2 Plant Protection at EQD „Bachelor“ in the majors „Plant Protection“ and „Master“ in the Master's program „Plant Protection“.

A decent place after the specialties in the FNS occupies the field of higher education Pedagogical Sciences. It provides training for bachelors, masters, and doctors (Tabl. 1).

Table 1. Profile of the majors in the field of higher education Pedagogical sciences, professional area Pedagogy of Teaching at the FNS



Today's students of pedagogy face the challenge of becoming teachers of a new generation. A generation, not only rich in information and digitally more recognizable, but also a generation with new motivation, new moral system, and civic conscience. In this way, the education of this new generation of students requires teachers to have appropriate pedagogical tools to manage and direct knowledge in a positive direction, to create a scientific space to effectively communicate and exchange information.

Teachers of the new generation should have developed social skills, which they can use to solve potential conflicts, situations of aggression or positive and a number of other pedagogical situations. It is relatively easy today to educate technically competent young people, but their transformation into future engaged citizens of our society requires the motivation, effort, and commitment of them to-be-teachers. This places one of the starting points for updating the competencies of future educators with concerning the improvement of their theoretical preparation for successful implementation of social competences in the learning process.

It the course of their preparation, the main directions of the modern educational reform in the world should be taken into account, that emphasizes the general tendency being the main goal of the school education in the natural sciences - the formation of natural science literacy [1, 2, 3]. It is interpreted as a combination of scientific competence in the field of natural sciences, knowledge of scientific methods and social scientific practices. Because of its importance at the present stage, science education must be directed towards its achievement [7].

This, however, is not easy - to design the training of pedagogical staff who can carry out science education in secondary school, with a focus on improving the public understanding of science as a whole. At the same time, its realization requires students to prepare the cognitive activity in a school, built on the analysis and understanding of the main scientific concepts and the related processes and phenomena, which underlie the rationalisation of the phenomena in the living and non-living nature and the scientific and technological developments; assessing their impact on the environment and people's lives, their importance and economic efficiency, and building skills to apply scientific knowledge and acquired competencies in real life situations.

These procedural aspects necessitate changes in the logic of the scientific platform, which is formed by the theoretical blocks of education of the respective twin specialties with pedagogical orientation, with a view to creating prerequisites for the realisation of interdisciplinary scientific synthesis and formation of complex themes that consolidate the specifics of instance of the relevant scientific fields studying nature -

geography, biology, chemistry and physics. It is necessary to pay more attention to the individual scientific courses in revealing the interrelationships between the different natural processes and phenomena and directing the cognitive activity to the formation of key competencies of practical importance.

At the same time, it is necessary to update the main accents of training in the pedagogical blocks of the specialties, in order to meet the state requirements for acquiring the professional qualification „Teacher“ [4]. For this purpose, from the 2017/2018 academic year, the curriculum of the students of pedagogy at the FNS complies with the requirement to determine the minimum number of compulsory courses and their minimum number of hours, including the following subjects: pedagogy, psychology, teaching methodology, inclusive education and information and communication technologies in teaching in a digital environment.

The prerequisites have been created to increase the optional courses divided into the following groups:

- first group – pedagogical, psychological and particular-didactic;
- second group – interdisciplinary and applied-experimental disciplines, oriented to key competences and related to the professional-pedagogical realization of the teachers.

Changes in the regulation of the organization and implementation of the basic stages of practical training of future teachers in the realisation of lesson observation, current pedagogical practice and internship practice are also positive. It is expected that students will have a stable theoretical scientific, pedagogical-psychological and methodological preparation upon completion of the training process of the given curricula, which will be strengthened in the practical training to form competencies for work in a real pedagogical environment.

We should not ignore the role the teacher has in society and what motivation the young people will have to acquire it. It is not by accident that internationally recognized requirements for good education indicate competent teachers and the commitment of the school system to educate children of all abilities [6]. This is the case in Finland, where the number of applicants for teachers is higher than that for doctors and the prestige of the teaching profession is really high, however, it is not in this country.

Involving suitable candidates for teachers requires certain economic incentives, such as the initial teacher's salary should not be lower than the average in other sectors of the economy. Conditions should be created in universities to purchase modern equipment every year with the opportunity to be used in the training process of future teachers, eliminating the imperfection of better technical equipment in most of the secondary schools compared to the higher institutions. More resources should be devoted to continuing education and training, which, when properly conducted, are a condition for reaching and maintaining a „good teacher“ level.

In order to confirm or reject these statements, as well as to establish the actual status and taking into account the expectations of the students in the pedagogical disciplines, a survey was carried out with 58 students of Bachelors of year 3 and 4 in the majors of Pedagogy of Geography and Biology Teaching , Pedagogy of Chemistry and Environmental Preservation Teaching and Masters in the programs Geography and Interactive Education and Methodology of Chemistry and Environmental Preservation Teaching from the Faculty of Natural Sciences at the Shumen University.

The questionnaire includes a total of six items that require an optional answer, the latter can be supplemented with a free answer. The outlined profile of the respondents is as follows:

- gender structure: 82% female, 18% male;
- educational structure: 73% EQD Master, 27% EQD Bachelor.

The first item examines students' attitudes towards the disciplines of the pedagogical profile. The results show that for 80% of them the attitude towards the analyzed disciplines is determined by the importance of the disciplines for their future realization. 10% of the respondents define the teacher's style as leading and 5% share the actuality of the curriculum and the specifics of the subjects (Fig. 3).

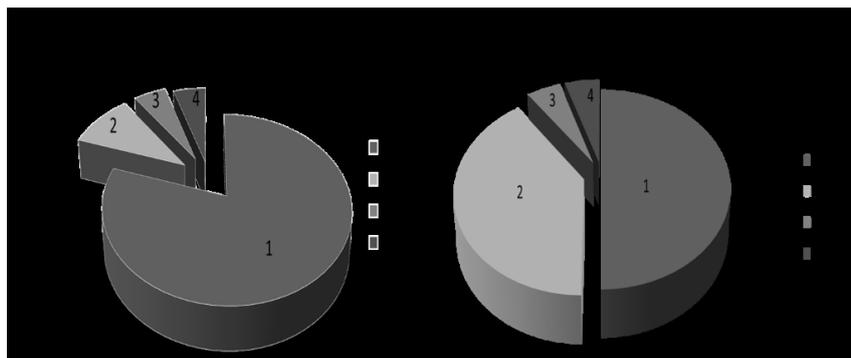


Figure 3. Results of items 1 and 2 answers

The answer to the second item detects the interest in the lectures on the relevant disciplines and the frequency of their visits. 90% of the students have attended 50 to 75% of the lecture course, which indicates their justified interest.

Figure 4 shows the results of items 3 and 4. The results of the third item explore the students' motivations for interest and visit the disciplines of the pedagogical profile. 47% of them determine as the main reason their importance for acquiring the necessary practical competencies concerning the execution of their future profession. Other motives relate to: building up the theoretical knowledge (23%), gaining professional self-esteem (17%) and a certain interest (13%). The fourth notion concerns the complex qualitative evaluation of the training in the disciplines of the pedagogical profile. For the majority of students, it is very good (50%) and good (30%).

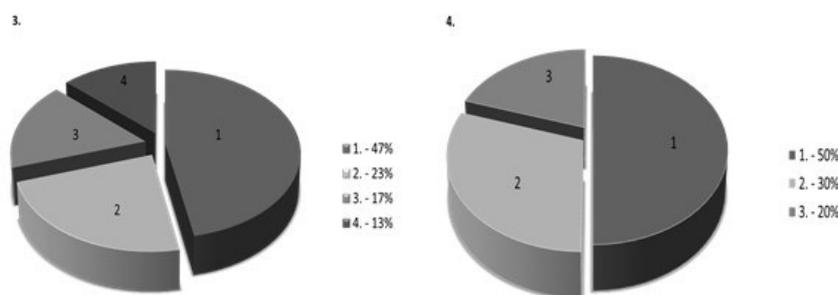


Figure 4. Results of items 3 and 4 answers

The next item examines the students' opinion regarding the presence of the disciplines from the pedagogical profile in the curricula of the studied pedagogical majors. For most of the students - 60% - they are sufficient and 25% identify them as insufficient in comparison with the other subjects. The remaining 15% cannot judge (Fig. 4).

The results of the sixth item are related to the difficulties encountered by the respondents in studying the disciplines from the pedagogical profile of the analyzed majors. Here the answers are the most varied. Students have pointed out the following difficulties - high teaching style (45%), lack of methodological literature (30%), mainly focusing on competence formation (20%) and use of specific terminology (5%).

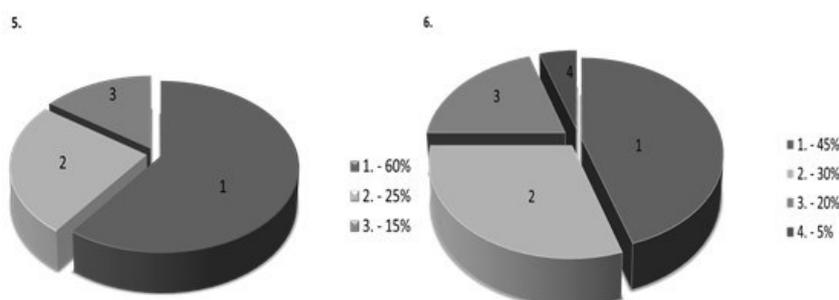


Figure 5. Results from items 5 and 6 answers

The mentioned didactic difficulties in studying the disciplines from the pedagogical block and the conduct of the pedagogical practice of the students objectively derive from their multifunctionality. The combination and successful realization of communicative, informational, training, educational, developmental, organizational and diagnostic function require from the to-be-teacher students not only in-depth theoretical knowledge but also certain personal qualities that will form the basis of their future professional competencies. The connection between the theoretical and practical training of all students is important, but students in pedagogical specialties acquire special importance. This also refers to the continuity between objectives, tasks, and content of the three stages of their pedagogical preparation.

The lack of faith in the students' own strengths and the concern about communicating with students are some of the most prominent motives that justify their pedagogical, psychological and methodical uncertainty in sampling lessons. Objective reasons for these findings may be the small number of hours of the disciplines of the pedagogical and psychological block, as well as the distance in the curriculum of the study of disciplines from the psychological-pedagogical cycle to the beginning of the pedagogical practice and mainly their theoretical orientation.

Conclusions

Some of these problems have been overcome in the new curriculum, where the expected results for the qualitative preparation of future teachers are greater. Other options are related to an increase in the number of optional subjects that directly correspond to the profile of student educators. In the process of their preparation, step-by-step activities can be successfully implemented to overcome the psychological difficulties of delivering the first lesson to eliminate the uncertainty of encountering an unfamiliar audience and others.

Acknowledgment

The present article is the result of the work on a project with the Scientific Research Fund, with the Konstantin Preslavsky University of Shumen, 2017.

References

- [1]. Dillon, J. On scientific literacy and curriculum reform. *Intern. J. Environ. & Sci. Educ.*, **2009**, 4, 201 – 213.
- [2]. Hodson, D. Why we should prioritize learning about science. *Canadian J. Sci. Math. & Techn. Educ.*, **2006**, 6, 293 – 311.
- [3]. Hurd, P. D. Science education for the 21st century. *School Science & Mathematics*, **2000**, 100, 282 – 288.
- [4]. Ordinance on the state requirements of acquiring the professional qualification “teacher”. *State Gazette*, 89, **2016**.
- [5]. National strategy for development of pedagogical staff 2014 – 2020. www.strategy.bg/FileHandler.ashx?fileId=462, **2014.**, 20.10.2017
- [6]. Savolainen, H. Responding to diversity and striving for excellence. *The case of Finland. Prospects*, **2009**, 39, 281 – 292.
- [7]. Tafrova-Grigorova, A. Scientific literacy – primary aim of the natural sciences teaching *Chemistry*, **2011**, 20, 490 – 495.