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The competency approach in the training of the future natural science teachers

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Abstract: *The competency approach is a promising path for improving the quality of education and life of the modern man. It is fundamental to the realization of the new educational paradigm. Its application in the training of future natural science teachers requires the creation of real professional situations that form the expected professional competences. The accent in the preparation of future teachers should be shifted to the process of knowledge with the realization of active cognitive activity of the students themselves.*

Keywords: *competency approach, natural science teachers*

Introduction

The new educational paradigm reflects the demands of a new society, built around an organization and stimulated by information, based on the explicit acceptance of democratic values and human rights. Today, every member of the civil society should be a participant and to construct his or her own personal and professional behavior.

This also applies to the Bulgarian teacher. In the modern society there is a change in the expectations of its activity, with the new perspective is complex and multilayer. The teacher should demonstrate and apply a mastered minimum of complex knowledge in a given scientific field and various didactic technologies in the constantly changing variety of pedagogical situations. The teacher should work for the formation of qualities in students like initiative, entrepreneurship and to form key competences, also to support their personal development and implements the ideas of inclusive education. In his professional development, he should fulfill a complex of professional roles and to implement different levels of interaction, in which he applied various professional competencies.

As with any other profession and in teaching the requirements for its implementation should be described by the respective professionogram. According to Vasilev and Merdzhanova, the components of the professionogram are the medical record, which indicates the requirements for health and the corresponding contraindications; the psychogram – the requirements of the profession to the psyche of the one who will exercise it and its limitations; Sociogram - the requirements for the social pedagogical image of the one who will exercise it and the limitations for its successful realization [21, p. 68- 69].

Related to the teaching profession, out of the components of the professionogram mentioned above, we will outline the basic directions of dimensions of psychogram and sociogram, which specify specific requirements for current teachers and for the preparation of future ones. According to Slavova, in the psychogram of the teaching profession, should include those minimum requirements of the profession for mental state of those who elect and those who practice the teaching profession, which would affect the mental state of the trainees. The sociogram of the teaching profession should include the basic socio-moral characteristics (qualities) of the person who chooses to prepare to be a teacher, as well as of the person who practices the teaching profession. As a component of the teaching profession's professionogram, a set of basic requirements for his / her vocational training and qualification should be present. The substantiation of a reliable teaching profession professionogram would help to optimize the processes of selection, academic preparation and professional realization of Bulgarian teachers [19].

The requirements mention above are relevant not only for Bulgarian teachers, but also for all those who are working in the field of European educational institutions. Depending on the guidelines of national education policies, each country looks for ways to create and adhere to certain standards in the teaching profession that can help to solve some of the problems in the field of modern education. European Commission working papers on quality assurance of the education in the 21-st century state that the European Union faces new challenges due to the globalization. In order to be resolved, all citizens should be able to acquire key competences by making all levels of education and training more attractive and effective [22].

An important task of education today is the training of competent professionals, i.e., people with knowledge and skills by which can be fully realize in the chosen profession. This task can be accomplished by using *the competency approach* in training. The increasing competition between the parties in the labor market force the searching for mobile, initiative professionals capable of making optimal decisions in different situations and this is one of the prerequisites for its using. Another prerequisite is the requirement for professionals to have a set of vocational-educational capabilities that ensure their versatility. N. Tsankov and L. Genkova emphasize that the competence approach is related to the new educational model and its application leads to improvement of the quality of education, by making it practically oriented [20].

Perceived as the foundation for a new educational paradigm, the competency approach is gradually being developed throughout the public practice as a tendency for the development of the modern man through continuous, competence-oriented education for everyone in the constantly globalizing world. This trend is not only European but also global. The World Educational Forum requests all countries to sign the Bologna Declaration, which point to the competency approach in developing national educational standards projects.

These facts shows that the competency approach is perceived, developed and refined by the international scientific community as a promising avenue for improving the quality of education and life of modern man.

With the introduction of the competency approach in the field of education, the development of the problem of *teacher competences* begins. A considerable number of studies in this field are currently published. Also in some countries, such as the USA, Canada, Japan, Australia, Switzerland, Turkey and others, there is a regulatory framework regarding the formation and assessment of teaching competences.

In Bulgaria, the competences that the teacher must possess in the respective field are regulated in Appendix No. 2 to Art. 42, para. 2, point 1 of Decree No. 12 on the status and professional development of teachers, principals and other pedagogical specialists [11].

In order to achieve these competences, the Higher School has the task to create the conditions for the development of the professional competences in the students, which are future teachers, and to assist them to grow as specialists in their own subject. Students who are future teachers should be able to

navigate the innovation of pedagogical science, to design and organize a learning process at school through the use of different pedagogical technologies, that is, to develop themselves as competent specialists.

Materials and Methods

The purpose of this study is to define the theoretical foundations for implementation and to clarify the role of the competency approach in the training of students in the subject of Pedagogy of training in Natural Sciences at the Faculty of Natural Sciences in Shumen University.

The research methods used are analysis of pedagogical, psychological and methodological literature and comparative analysis.

Results and Discussion

Competencies – Competence

The competence orientation of the educational process is directed towards goals which are related to motivation, self-determination, socialization, development of individuality. Tools for achieving these goals are new educational concepts like competencies, competence, professional competence and others.

One of the problems that a researcher in the field of competence has paid particular attention to in the 1990s is related with the distinction between the terms "competencies" and "competence". The use of the two terms leads to confusion, which most of them consider undesirable during this period. According to M. Armstrong, the mixing of the two terms initially began in the UK, and subsequently some authors began to regard them as synonymous. M. Armstrong distinguishes the two terms as follows:

- competence is a human-related concept that refers to aspects of behavior behind competently performed work;
- competencies is a job-related term that speaks to the field of professional activity in which a person works [By 5].

Considering this problem, it should be noted that in the psycho-pedagogical and methodological literature studied today we do not find a consensus on the definition of the concepts of competence and competency [16, 3, 9, 17, 20]. Part of the authors, to whom we adhere to, define competencies as "... a necessary result of the trainees' educational activity, which includes not only knowledge but also learned methods of action, personal qualities necessary for productive activity" [20].

According to V. Naydenova, **competency** is "... a mastered set of interrelated personal qualities (knowledge, skills, habits, methods of action) referring to a certain range of objects and processes necessary for productive activity" [16].

In the EQF, competencies are seen as 'comprehensive mastery of specific knowledge, skills and behavioral models in a flexible way. Competencies are an individual's readiness to effectively organize internal and external resources to achieve goals and his / her ability to accomplish a particular class of professional tasks [1]. Therefore, competencies are the result of the trainees' educational activity, which includes not only knowledge, but also the learned methods of action and personal qualities which are necessary for productive activity.

Competencies can also be understood as a capacity for self-organization. This is every action in situations of discovered problems and complex systems. The general ability to be active and creative, reflexive of yourself, technical and methodical to environmental conditions and communicative with others.

There are different definitions of the concept of **competence** as well.

Russian teacher V. A Hutorski defines competence as "... a set of personal qualities of a student (value-meaning orientation, knowledge, skills, habits, abilities), conditioned by the experience gained from his activity in a certain socially and personally meaningful sphere. Students competence implies to a minimal experience for applying competencies" [7]. In the European qualification framework competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development [1]. It is formed on the basis of cognitive properties and on the valuable practical experience of the person, allowing the effective solving of the problems and defines the person as competent to a certain extent.

According to the International Council for Standards and Training, Performance and Teaching, a competence includes an appropriate set of knowledge, skills, and attitudes that enable an individual to

effectively perform the activities of a profession, or to work in a manner that is appropriate or exceeds the standards in a particular profession or work environment [18].

According to Ya. Merdzhanova, "The dual complex of competence - competencies characterizes two interrelated aspects of human professional activity. The competence is used when we have to characterize the specialist's professional-personal profile and the quality of his attitude towards the subject of his professional work. While competencies fixes professional powers for certain professional activities and functions that are attributed to the specialist with exactly this certificate and exactly for this position and position in the professional hierarchy" [10].

Competence also manifests itself as "... an integral characteristic of the individual, as a system of competencies structured in a particular way and integrating knowledge, skills, and the individual's attitudes toward himself, others, to his activity and results" [20]. Adhering to this interpretation for the realization of the purpose of this study, we specify that the system of competences should be complex and to include those that guarantee the successful preparation and professional realization of future students as natural science teachers, as well as the positive attitude of students in the future pedagogical communication for realization of positive pedagogical activity results.

Nowadays particularly relevant in secondary education are *key competences*, they are part of the recommendation of the European Parliament and of the Council of the European Union to provide key competences for all, as part of Member States' lifelong learning strategies. The eight key competences defined in the European Framework of Reference for Key Competences are crucial for human development and are needed for their personal realization and development, adaptability to the constantly changing labor market, social inclusion, sustainable lifestyles and active civic participation.

The overall concept of the place and role of key competences in Bulgarian schools training is presented in the National Lifelong Learning Strategy 2014-2020. One of its main tasks is to encourage the acquisition of universal key competences such as learning skills, initiative and entrepreneurship, cultural awareness, and the so-called "Soft skills" (the ability to work in teams, to make decisions, to resolve conflicts, etc.). It also emphasizes the holistic approach of acquiring nine key competences for lifelong learning in a common process [15]. These competences are designed in the Law on Pre-school and School Education and they are the same as these in European Framework of Key Competences. There are one additional competence added to the Law on Pre-school and School Education – "skills to support sustainable development and a healthy lifestyle and sport" [23].

The subsequent ordinances for the implementation of the law do not explicitly specify the expected results for the development of the nine groups of key competences at the end of each educational stage. This leads to the lack of a unified approach to their inclusion in the different subject's curricula. In them, the selective attachment of certain competences to specific subjects does not imply their full implementation in the teaching process and partially limits the freedom and motivation of the teacher to form those competences in his students, which he identifies as important to them.

The key competences are subject to partial assessment only with regard to National External Assessments in grades IV, VII and X and due to that fact their importance is partly undermined. There are other unclear issues regarding the concrete implementation of key competences in the real learning process, which speaks of incomplete coordination between the learning content and the expected training results and creates additional obstacles for teachers to develop competences due to their lack of real interweaving with the syllabus. The curricula lack the precision of the proposed activities for their acquisition, there is a mix of competences in the respective subject with key competences, and there is a repetition of the same activities in the programs of different classes and school subjects.

There is a lack of a comprehensive concept for the inclusion of key competences in the learning process at school and in the analysis of the National Teacher Development Strategy 2014-2020 [14]. The National Teacher Development Strategy 2014-2020 does not deliberately mention the need for teachers' qualifications to be oriented towards the development of these knowledge and skills that the teacher needs in order to develop key competences in his students. Key competences are mentioned only in relation to the development of teachers' personal competences but not in the formation of such competences in students [8].

The same conclusion can be made with regard to the Decree on State Requirements for the acquisition of professional qualification called "teacher" [12]. In the Decree there is a lack of specific requirements for incorporating key competences in the preparation of future teachers. This is left to the discretion of universities as part of their right to independently develop and implement curriculum. After all the application of the competency approach in secondary and tertiary education is essentially its alignment with the new conditions and trends and a manifestation of its strategic orientation towards self-renewal.

Professional and pedagogical training of students

In the context of the competency approach, the vocational and pedagogical preparation of students - future teachers are a problem of particular relevance due to its social and pedagogical importance. The formation of professional competences in students is realized through theoretical (general scientific, psycho-pedagogical and didactic) and practical training in the compulsory and elective courses, set in the curriculum of the respective specialty.

In accordance with the National Qualifications Framework of the Republic of Bulgaria (NQF), which is compatible with the European Qualifications Framework for Lifelong Learning, adopted in 2012, the acquisition of a qualification called teacher takes place upon receipt of Level 6: Professional Bachelor degree – Sub-Level 6A and Bachelor degree – sublevel 6B.

In the NQF, the competences are structured in 4 subgroups: independence and responsibility; competences for learning; communication and social competences; professional competences (Fig. 1). The formation of these mentioned the last requires the Bachelor degree to have the competence to: "collect, classify, evaluate and interpret data in the field in order to solve specific tasks; apply acquired knowledge and skills in new or unfamiliar conditions; shows the ability to analyze in a broader or interdisciplinary context; uses new strategic approaches; forms and expresses own opinion on problems of social and ethical character arising in the process of work" [13].



Figure 1. Subgroups of competences according to the national qualifications framework

The aforementioned professional competences are commonly formulated and find concrete expression in the Decree No. 12 from 01.09.2016 on the status and professional development of teachers, principals and other pedagogical specialists, as well as in the educational documentation of pedagogical specialties in the respective higher education institution [11].

In Appendix No. 2 to Art. 42, para. 2, point 1 in Decree No. 12 regulates the competences that determine the professional profile of the teacher - academic competence; pedagogical competence; communicative competence and administrative competence (Fig. 2). The respective knowledge, skills and attitudes are also associated with them.

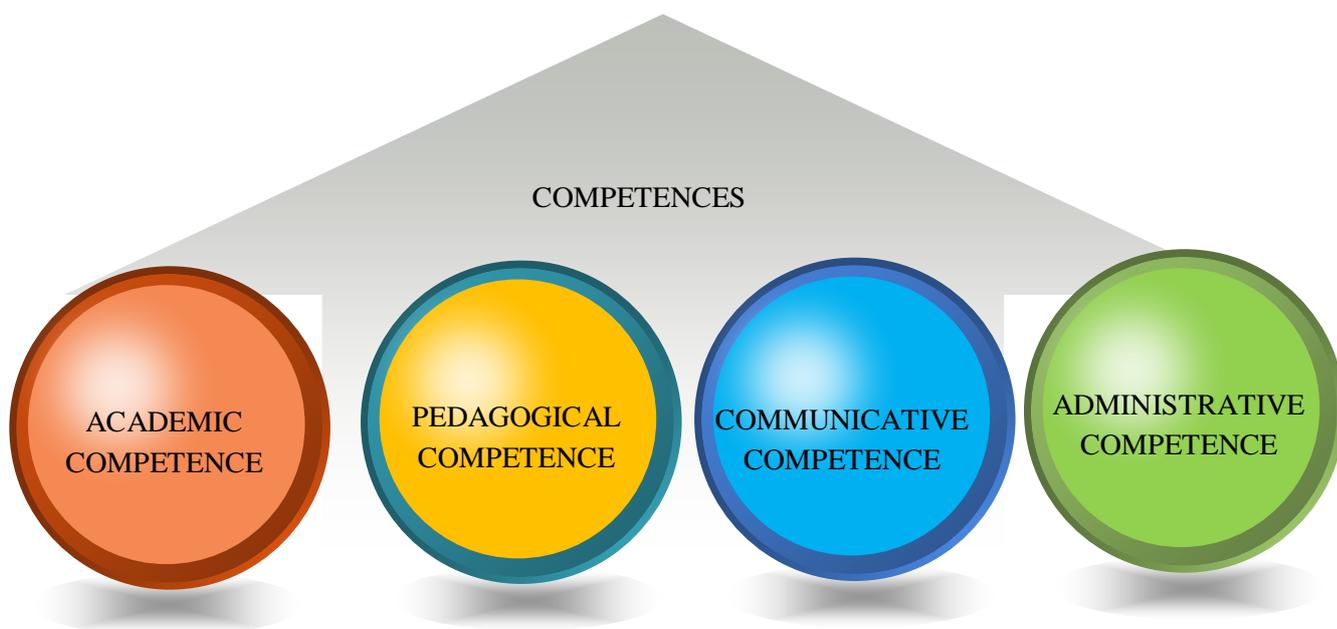


Figure 2. Competences defining the professional profile of the teacher

Academic competence includes initial vocational training (pedagogical, psychological, methodological, specialized) and lifelong learning skills. This is the part of teacher preparation that needs to be built within university education. Special attention will be given to it in the analysis of the educational documentation for the preparation of the future natural science teachers at the Faculty of Natural Sciences of the Shumen University.

Among the set of regulated competences that determine the professional profile of the teacher the *pedagogical competence* stand out, which is an important basis for successful professional realization. It implies formation of skills for lesson planning, organizing and directing the educational process, assessing student progress, and managing processes in separate groups or classes. The formation of this type of competence is closely linked to the basic pedagogical preparation of future teachers. It is given special attention and is seen as a decisive factor in achieving the quality of education [2]. Studies are being conducted in Bulgaria to determine the current state of the basic teachers training, which establishes the necessity of developing and validating a unified and not contradictory system of basic pedagogical training and qualification in accordance with the needs of the society in the long term and with contemporary achievements and trends in European scale [6]. Undoubtedly this will have impact on the requirements for the training of teaching staff in the universities.

Communicative competence is a set of communication skills for adequate communicative behavior by participating in different communication activities and the implementation of different communication situations in the pedagogical process. It involves not only knowledge and skills for communicatively adequate behavior, but also personal and professional skills for dealing with the challenges of school daily life. It includes a set of communication knowledge and communication skills under the changing conditions of communication with modern students. In the context of pedagogical professionalism, communicative competence is most closely linked to the other types of competence and two individual aspects of it can be distinguished – basic communicative competence and professional communicative competence [4, p. 114].

Administrative competence is related to the legal and ethical issues of a teacher's professional activity. According to them, the teacher should recognize and to apply the legal framework of the school education system, to comply with the legal norms that are relevant to professional rights, obligations and its employment relationship.

At the same time, it must be sufficiently acquainted, in order to apply the National educational standards for the information and documents, educational and school documentation of the educational institution, the terms and conditions for its adoption, creation, keeping, reporting and destruction. In

his/her administrative activities, the teacher must respect professional ethics and, if necessary to counteract illegal, corrupt and other acts that undermine the prestige and reputation of the educational institution.

All the theoretical aspects of the competency approach that are analyzed determine the necessity of its application in universities in the preparation of future teachers. At the same time, they also put certain challenges, which are related to a number of difficulties regarding to its complex nature and the necessity to upgrade the basics that are built in secondary school.

The specialty "Pedagogy of Natural Sciences Education" at the Faculty of Natural Sciences of the Shumen University is one of the newest. The training in it starts in the academic year 2019-2020. Its main purpose is to prepare competent and competitive teachers in the following school subjects: Man and nature, Physics and Astronomy, Chemistry and environmental protection, Biology and health education. They should be able to carry out educational, scientific, methodological and organizational activities in the educational system in accordance with the specialty obtained. The bachelor's degree teaching documentation designs the requirements of the competency approach and is reflected in the qualification characteristic by highlighting the following competencies of the future natural science teachers – personal, professional, instrumental and technological.

In order to achieve the purpose mentioned above, the training focuses on the formation in the future teachers of knowledge, skills, vocational and pedagogical competences, motivation for lifelong learning, the ability and striving for continuous self-improvement and self-education that are necessary for ensuring a quality educational process.

Along with them, in the course of the educational process, students work to build personal competences that provide the future specialist with the opportunity to adapt to the conditions and requirements of the professional environment, as well as for their own further professional development: language culture, computer literacy, skills to work in an intercultural environment, teamwork skills, ethics, and tolerance.

In the qualification characteristic of the specialty have been specified the general professional competences defined in the NQF. In their direct professional activity, graduates in the specialty of the Pedagogy of Natural Science in Bachelor's Degree must have the following competencies:

- to plan, organize, analyze and manage competently the educational process;
- to select the optimal set of approaches, methods, tools and forms for the realization of a modern learning process;
- to use modern technologies for diagnostics and evaluating the quality of the educational process;
- to process and analyze the results of the control of the indicators that determine the level of students' preparation;
- to develop and implement methodological models, methodologies, technologies and training techniques;
- to plan, organize and conduct extracurricular forms of work;
- to work in a team with colleagues in realization of interdisciplinary organizational forms;
- to realize scientific and applied researches, to summarize their experiences and to participate in scientific forums.

Based on the understanding that the competences are result of training, the educational process at the university should be organized in such a way as to create real professional situations in which the expected professional competences are formed in future teachers. Thus, in the educational process based on the competency approach, a certain connection is established between knowledge and skills, the subordination of acquired knowledge to professional skills, which contributes to the fact that education becomes personally important for the student (Fig. 3).

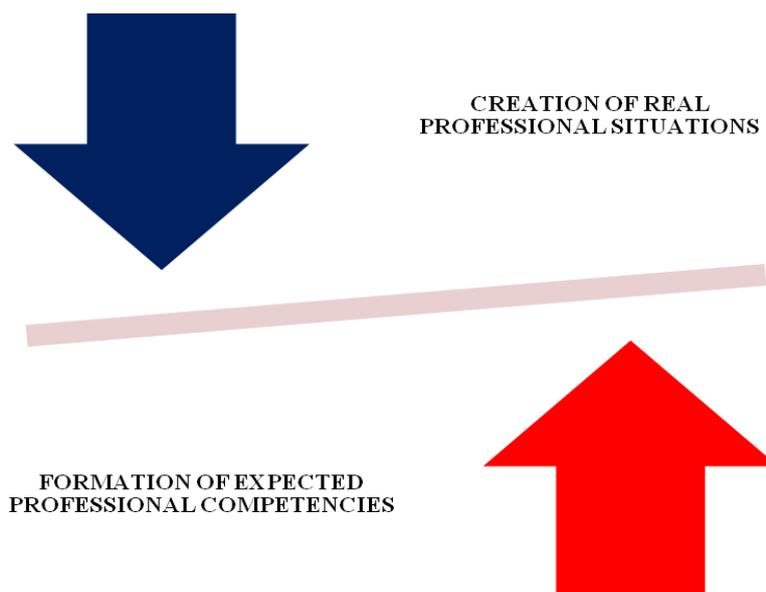


Figure 3. Competencies as a result of university education

The change in the organization of the learning process is a necessary but far insufficient condition for the formation of professional competences in students. Equally important issue is the choice of forms and methods of training. One of the main characteristics of graduates in the pedagogical specialties is their mobility, the ability to independently acquire knowledge and quickly to navigate in the innovative processes in education. Therefore, the emphasis in their preparation should be shifted on the process of knowledge, the effectiveness and efficiency by which the active cognitive activity of the student depends. The competences formed in this case depend not only on the theoretical knowledge acquired by the trainees during their education, but also on how they acquire this knowledge: based on memorization or through the development of thinking, by using reproductive or active methods and forms of teaching.

Conclusions

Based on the above, we can summarize:

- The competency approach is perceived, developed and refined by the international scientific community as a promising way for improving the quality of education and life of a modern person.
- The competency approach is fundamental for the realization of a new educational paradigm for development of modern man through continuous, competence-oriented education for each one and all in the globalizing world.
- With the introduction of the competency approach in the field of education, the development of the problem of teacher competences begin, which are complex and varied with a view to a successful professional realization.
- We adhere to the view that competencies are necessary result of the educational activity of the trainees, which includes not only knowledge but also learned methods of action, personal qualities needed for productive activities.
- The system of competences for the training of future natural science teachers is complex and includes those that guarantee successful preparation and professional realization, a positive attitude in the future pedagogical communication for the realization of positive results of the pedagogical activity.
- It is necessary to create conditions for inclusion of the key competences in the preparation of future natural science teachers.
- The formation of professional competences in the students trained in specialty of pedagogy of natural science education is realized through theoretical (general scientific, psycho-pedagogical and didactic) and practical training through compulsory and elective disciplines included in the curriculum of the specialty.

- The professional profile of the natural science teacher is defined by academic competence, pedagogical competence, communicative competence and administrative competence.
- In order to realize the competence approach, it is necessary the educational process at the university to be organized in the creation of real professional situations in which the expected professional competences will be formed in the future science teachers.
- The emphasis in the preparation of future teachers should be shifted to the process of knowledge, the effectiveness and efficiency of which depends on the active cognitive activity of the students themselves.

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