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**TRAINING OF NATURAL SCIENCE TEACHERS AS PART OF  
LIFELONG LEARNING**

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***Abstract***

Teachers who are familiar with the basics of the theory and methodology of teaching academic subjects are the only ones who can provide high quality of graduates' training and solid students' achievements. Today, there is a growing interest in the training of highly qualified personnel, their long-term employment, professional development and motivation to work. The article studies the problem of chemistry and geography teachers' professional training in the system of higher education, their further professional training and retraining as part of lifelong pedagogical learning that is relevant for the didactics of the natural science education. School practice shows that many teachers are still focused on the translation of subject knowledge; and its assimilation provides the results of the unified state exam and prepares for universities, which does not contribute to the development of students' competences such as cognitive initiative, risk of choice, commitment to the realization of cognitive interest and novelty. In the process of studying natural sciences, a student master's knowledge and skills in a particular subject area. Competence, in its turn, shows how students have mastered professional functions that they have to perform, that is, they master not only subject-related, but also meta-subject experience. Competence means a motivated sequence of actions in a specific context. As a result, such skills as observing, explaining, classifying, summarizing, recognizing, predicting, drawing conclusions can be developed through an experiment, modeling, design, construction; can develop and be filled with specific content. Universal ways of activity are assimilated on this basis.

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**Keywords:** Education, bachelor, competence, further training, retraining.



## **1. Introduction**

The All-Russia People's Front, together with the National Education Resources Foundation, conducted a survey among parents of schoolchildren and revealed which are the worst-taught subjects, in their opinion. About 39% of the respondents are dissatisfied with the quality of chemistry, geography and biology teaching. According to the parents, one of the main problems of school education is the lack of practical focus. Today, it is becoming obvious that we see the emergence of a new educational reality which is mainly characterized by complexity, nonlinearity, innovation and ambiguity (Ivanova & Serikov, 2017). Parents believe that school pays little attention to teaching children how to make decisions independently and plan their own actions, as well as to develop the skills of finding different ways to solve educational problems and to choose the best or the most efficient out of them.

## **2. Problem Statement**

We share the opinion of many respectable experts in the field of pedagogical sciences that instructors and teachers are the main engines of progress. Amid rapid social changes, the problem of the priority development of pedagogical education is becoming particularly acute. It is well-known that the more efficiently the pedagogical education fulfills its mission, the more educated and smarter the society of the future, the richer the culture and the higher the quality of life will be (Ivanova, 2016). What needs to be done to train a good teacher? How to carry out professional retraining of teachers in the natural science cycle in the context of post-graduate education?

## **3. Research Questions**

- to determine the competencies of the future subject teacher, serving as benchmarks for the training and retraining of the teaching staff;
- to adjust the content of educational programs in order to reasonably combine traditional knowledge-oriented and competency-based approaches in favor of the latter;
- to identify the features of lifelong pedagogical learning at the present stage.

## **4. Purpose of the Study**

Identify the areas for improving the methodological system of developing professional competencies at university in the course of training and retraining of teachers.

## **5. Research Methods**

The following methods were used in the course of the research: analysis of didactic and methodical literature as well as school practices; global trends in the development of education; comparative analysis of pedagogical experience; experimental approbation of the developed methodology amid modern information environment at school and university.

## 6. Findings

The problem of natural science teachers' training as part of lifelong pedagogical learning that is being studied in the paper requires a fundamentally new philosophical understanding.

In the context of the competency-based approach implementation, teaching the subjects of the natural science cycle in general secondary education institutions involves the formation and development of students':

systemic knowledge, creating the basis for lifelong learning and self-education at all stages of training and upcoming professional activities;

socially significant value systems, including the general cultural and personal development of students, understanding the value of education received, a sense of responsibility and patriotism, social mobility and the ability to adapt in different real-life situations;

key competencies (knowledge, skills, methods and experience in activities considering the specific features of subjects as fundamental natural sciences), ensuring the achievement of subject and meta-object learning outcomes.

New types of activities, such as academic and research and project activities, have emerged as a response to the challenges of modern society. At the same time, experimental and intellectual skills of planning, modeling an experiment, forecasting and interpreting its results, constructing a hypothesis, testing it, etc. are developed (Volkova, 2018a).

It is obvious that in this regard, radical changes are needed in the methods of teaching natural science disciplines, i.e. a transition from techniques that focus only on the assimilation of subject knowledge, to the development of methodological systems that ensure the assimilation of universal methods of work, the achievement of creative and personal results of educational activities (Ivanova & Serikov, 2017).

Modern researchers in pedagogy and teaching methodology attach great importance to personal educational results: the ability to learn, achieve life goals independently, obtain practically important knowledge and skills, "skills of the 21st century" (Zhilin, 2011; Hayden, Thompson, & Williams, 2003; Schleicher & Ramos, 2016), ability to achieve self-fulfillment and self-development; there are models of "educational achievements" (Wagner, 2008).

However, in practice, we see a "cult of uniformity" that restrains the development of gifted students. A scientifically-based teacher retraining system as part of lifelong pedagogical learning should be aimed at resolving these contradictions.

The Federal State Educational Standard of Higher Education (FSES HE) in 44.03.05-Pedagogical education (qualification (degree) "bachelor") provides for mastering a whole range of professional competencies that require the knowledge of basic academic disciplines (Ivanova, 2016; Federal State Educational Standard of Higher Education in 44.03.05-Pedagogical education (qualification (degree) "bachelor")). However, in the process of implementing the FSES HE requirements, we face serious difficulties and problems that were actively discussed in the Chemical and Pedagogical Education section at the Russian Congress of Chemistry Teachers and Instructors, which took place on February 5–7, 2019 at Lomonosov Moscow State University.

The pedagogical problem consists in the fact that, for example, at Kaluga State University (KSU) named after K.E. Tsiolkovsky, pedagogical education is implemented in two disciplines – biology and chemistry. At the same time, the main focus is on biology. A bachelor's degree in pedagogical education gives the right to equally teach both biology and chemistry. In this regard, it is necessary to make changes to the FSES HE, fixing the uniform distribution of the volume of study load between them. It became obvious that in the course of training experts, special attention should be paid to the expertise of a bachelor student working at school. It is possible to continue studying on a master's degree program or to bring back specialty programs to pedagogical education.

In the course of bachelor's educational programs, students undergoing a pedagogical internship face difficulties in preparing methodological materials for classes, drafting task sheets, taking into account all the requirements for the results of mastering the principal educational program of the FSES of general education, reasonable application of information and communication technologies (ICT) in educational activities, leading academic projects.

Thus, each university graduate – a young teacher – needs psychological, pedagogical and scientific-methodological support. The system of further professional training in the Moscow region, namely Moscow Region State University (MRSU), offers online further professional training courses in the form of webinars for teachers with up to a 3-year experience.

The survey on the identification of professional deficiencies notes that young experts would like to be assisted in the following areas: the subject teaching methodology, the use of modern pedagogical technologies, the use of ICT in professional activities, the resolution of conflicts. Today, the Teacher's Activity on Conflict Resolution in an Educational Organization (Mediation) program is being implemented, and the use of information technologies in education is also being considered. The following topics are offered to young experts: "Application of test shells in knowledge control", "Development of young teacher's stress resistance in the process of professional adaptation", "Efficient interaction of a young teacher with student's parents", "Time management for a young teacher", "Application of information technologies in project and research activities", "The use of presentations in the work of a teacher. General rules for the presentation of visual information", "The use of Internet resources in teaching activities" (Solodukhina, 2017).

Requirements for the level of teachers' expertise are growing systematically; for each teacher the question of lifelong learning, where "lifelong learning" is replaced by the motto "learning throughout life", is becoming relevant.

Therefore, not only young teachers, but also geography teachers with over 3-year experience, undergo further professional training programs at MRSU. They are offered an advanced training program on Innovative Approaches in Teaching Geography Amid Implementation of the Federal State Educational Standard of Compulsory Education.

Teachers of the Moscow region can be trained in the system of online further professional training for teachers and heads of educational institutions of the Moscow region. In this system, a course for geography teachers is in the form of an Adaptive Modular Online Course (AMOC). AMOC on geography includes 9 modules that a teacher chooses from the list. Among them are "Designing the Educational

Process on Geography in a General Education School"; "Organization of Extracurricular Activities in Geography"; "Updating the Technology of Teaching Geography in a General Education School."

Another problem we are facing in our work is thematic training. Under the traditional approach, the main content of the educational process consists in mastering a particular topic or section of the program. As a result, a competence-based approach to learning conflicts with the traditional "knowledge-oriented" thematic learning, when competence acts as a unit of content and activity (Petrova, Fadeeva, & Bazanov, 2018).

Competence as a unit of activity is determined by the triad: motivation → context → technology and algorithms or in other words, as a motivated sequence of actions in a specific context (Serikov, 2018).

The context is thus a common link in both traditional and competence-based approaches. The context itself is determined by the content. That is why natural science education should feature contemporary natural science researches on successes, problems and evils of modern society, the results of achievements in the field of science and technology, as well as relevant problems of an inter-scientific nature. This must be taken into account when updating the content of natural science education (Federal State Educational Standard of Higher Education in 44.03.05-Pedagogical education (qualification (degree) "bachelor"); Carnoy, Khavenson, Loyalka, Schmidt, & Zakharov, 2016).

## 7. Conclusion

The main objective of the university, which trains future teachers, is to keep in touch with graduates, carry out mentoring activities and develop a system of lifelong learning for teachers. Participation in various conferences, events, university projects for schoolchildren and teachers, training under further professional training and retraining programs full-time or distantly determines whether the teacher passes certification procedures for professional growth and development successfully.

Distance learning includes various forms of classes, and the presentation of course materials, multimedia lectures, a forum, video lectures by the course author, webinars, testing, interactive materials, electronic learning resources, etc.

However, we should note that, despite the heightened interest in the use of ICT in professional activities, less than a third of the teachers surveyed regularly take part in open online events – webinars, video conferences, and large scale open online courses. This shows the lack of awareness of a teacher in the field of self-education or the lack of the necessary competences for the use of Internet resources.

The system of further professional training of pedagogical personnel faces a number of problems, including: little time dedicated to the study of relevant issues connected with an academic subject teaching methodology; reduced hours devoted to the study of subject-related issues, due to the increase in time dedicated to the study of general pedagogical topics.

To solve these problems, it is necessary to develop fundamental competences in future teachers that will enable them to master any continuously changing knowledge that reveals the evolution of nature, society and science (Blaschke, 2012; Volkova, 2018b). It should be noted that there are few works on this subject. Comparative studies take a special place among them (Graduate employability in Asia, UNESCO, 2012; Lavonen, Sothayapetch, & Juuti, 2013).

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