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**INNOVATIONS IN ADVANCED PROFESSIONAL  
DEVELOPMENT SYSTEM FOR TEACHERS WORKING WITH  
GIFTED TEENAGERS**

S.I. Gilmanshina (a)\*, Y.N. Shtreter (b), I.R. Gilmanshin (c)  
\*Corresponding author

(a) Kazan (Volga region) Federal University, 18, Kremlyovskaya str., Kazan, 420008, Kazan, Russia,  
gilmanshina@yandex.ru, +79272409728

(b) Kazan (Volga region) Federal University, 18, Kremlyovskaya str., Kazan, 420008, Kazan, Russia,  
juliashtreter@mail.ru, +79173940053

(c) Kazan (Volga region) Federal University, 18, Kremlyovskaya str., Kazan, 420008, Kazan, Russia,  
is-cr@yandex.ru, +79272409727

*Abstract*

The relevance of the chosen topic is due to the increasing gap between the content of subjects and Olympiad tasks (tasks given at academic competitions). We need to provide scientific and methodological assistance to teachers who are mentors of gifted pupils – the participants of Olympiads (academic competitions) at a high level. Reputable universities play an important role in this process. The study presents the developed and tested system of professional development of chemistry teachers who work with gifted teenagers. The purpose of the study is to explore scientific and pedagogical support for the professional development of teachers in their work with gifted adolescents and its innovation component (on an example of chemistry teachers). It was revealed that scientific and pedagogical support integrates the five implemented in practice independent modules. It was found that innovation component is best reflected in the conditions of the first module. It is associated with the use of new chemical equipment, modern information and communication technologies, and combined work experience on the basis of lyceum for talented children, unique pedagogical chemistry workshops; it is characterized by strong interactivity and performance by the students of creative project-oriented final reports. The materials of the article have the practical value for students – the future school teachers and university professors, for participants of the refresher courses and educationalists.

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**Keywords:** Education, professional development, teachers, gifted teenagers.



## **1. Introduction**

The increasing gap between the content of basic school educational programs on the subjects and materials used during the preparation of the tasks for Olympiads at various levels, starting from the municipal stage of all-Russian Olympiad, clearly dictates the need for periodic professional development of school subject teachers. Especially scientific and methodological assistance is necessary for the teachers who are mentors of gifted pupils – the participants of the high level Olympiads. There is no doubt that, along with a wide range of independent competence on the subject in the work with gifted teenagers through the study of the special literature (Kuramshin et al., 2013; Gilmanshina et al., 2016) and on-line courses, an important role in the teachers professional development should play an authoritative institution of high education. In particular, Kazan (Volga region) Federal University, where take places a good combination of almost 140 years of experience in teacher training and world-known scientific schools, such as the Kazan chemical school.

## **2. Problem Statement**

In the study (Gilmanshina, Khalikova, 2015) the phenomenon of "giftedness" is investigated and new forms of work with talented youth in the University education system are considered. This research is devoted to teaching chemistry to gifted youth in transforming science education (Gilmanshin, Gilmanshina, 2016; Gilmanshina & Gilmanshin, 2015; Gilmanshina et al., 2016; Gilmanshina & Khalikova, 2016). This study is devoted to methods of teaching students the scientific explanation of chemical phenomena (Gilmanshina et al., 2016). Interesting method of teaching chemistry that was designed for motivated students is presented in (Sulcius, 2015; 2016), the research student's activity who will be the teachers in the future is analysed in (Lamanauskas & Augienė, 2016; 2017). Features of modelling of professional orientation work with pupils and students in the system "school – College – enterprise" studied in (Sibgatova et al., 2015). The questions of readiness of teachers to work in multicultural educational space is represented in the works (Gabdulchakov & Shishova, 2017; Sabirova et al., 2016; Valeeva & Kalimullin, 2016). However, the analysis of scientific works devoted to the study of scientific-pedagogical support of the teachers professional development process according to the work with gifted teenagers and its innovation component is extremely small and they are fragmentary-debatable.

## **3. Research Questions**

What is the content of scientific-pedagogical services and innovative component of process of teacher's professional development to work with gifted teenagers.

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

To develop scientific and pedagogical support and innovative component of process of teacher's professional development in the work with gifted teenagers (on an example of chemistry teachers).

## 5. Research Methods

The leading approach of the study is competence-activity approach, which involves cultural and personal development of teachers, construction of educational process taking into account individual age, psychological and physiological features of participants of professional development courses. The term competence-activity approach appeared as a result of the combination of competence-based and activity-based approaches. If competence-based approach requires the formation of competences, development of personal qualities and strengthening of practice-oriented education, the activity-based approach proves the futility of knowledge and skills which are not implemented in productive activities. The basic position of the activity-based approach is due to the fact that the psychological abilities of the person are the result of the conversion of the external subject activity in the internal mental activity through successive changes. The development of an individual is determined primarily by the nature of the organization, its learning activities. In accordance with the activity-based approach the content of education determines the type of thinking, depending on the learning content. Knowledge and skills are considered to be derived from the relevant types of purposeful actions. The quality of learning is determined by the diversity and nature of the types of learning activities. The activity-based approach can be effectively combined with modern educational technologies such as information and communication, technology, research and design activities, technology, problematic learning

## 6. Findings

### 6.1. Structure of scientific and pedagogical system of professional development of chemistry teachers and its innovative component

Innovation component of scientific and pedagogical support of the system of the professional development of chemistry teachers is due to the fact that the courses classes are taught by experienced teachers using modern chemical equipment, information and communication technologies. In addition, in April 2017 in the KFU starts operating unique pedagogical chemistry workshops, they demonstrate modern methods of work with gifted teenagers in the area of chemistry. Overall scientific and pedagogical support of the innovative system of teacher professional development in the Butlerov chemical Institute includes the following five independent modules.

Module 1. Programs of professional development and retraining teachers, implemented jointly with the Volga interregional centre of professional development and professional retraining development of educators of Kazan Federal University (KFU).

Module 2. Seminars for chemistry teachers on training students for the Olympiads jointly with the Institute of Educational Development and the Republican Olympiad Centre of The Ministry of education and science the Republic of Tatarstan.

Module 3. Video tutorials and webinars for chemistry teachers and students according to the solution chemical tasks of high complexity, including Olympiad content, together with the Acceptance Commission KFU.

Module 4. Methodological assistance to teachers and students of Tatarstan in preparation for Unified State Examination (USE) in chemistry together with the Department of education KFU.

Module 5. Master classes for solving tasks of high complexity and Olympiad tasks in conjunction with local educational authorities and private educational institutions of general education of municipal districts of Tatarstan.

## **6.2. The content of scientific-pedagogical system of professional development of chemistry teachers**

The first module fruitfully implemented since 2012. In 2016 jointly with the Centre of professional development and professional retraining development of educators and Department of chemical education KFU worked out 4 programs (108 hours each) with 12 groups of chemistry teachers of different qualification categories (only 290 teachers). Programs include distance and in-class stages of learning. Telecommuting contains teachers work with e-lectures presented in the learning management system "Moodle" and the passage of appropriate control knowledge. At the stage of full-time study teachers attend lectures and practical classes conducted by professors and associate professors of the University, participate in master classes and various trainings in the best educational institutions of Kazan city and protect their own drafts. Retraining teachers is maintained by the program "Science with the right of teaching chemistry".

The second module reflects the joint activity with the Institute of Educational Development of the Republic of Tatarstan and Republican Olympiad Centre of The Ministry of education and science the Republic of Tatarstan. The Republican training seminars "Organizational and pedagogical conditions of training students for the Olympiads" 108 hours. Seminars are conducted in three stages, usually in April, July and November, to complete teachers receive the document of professional development.

As an example, consider the organizational substantial component of seminars 2015. The lessons were led by the head of chemical education Department and representatives of other departments of A. M. Butlerov chemistry Institute, who had previously attended the regional and final stages of all-Russian chemistry Olympiad (winners and later the leaders of the jury). The professional development was attended by fifty teachers of the Republic of Tatarstan.

The list of topics of seminars was very versatile. Teachers have been worked out especially algorithmic and heuristic techniques of solving chemical problems of advanced complexity level on such topics as "Thermochemistry", "Electrolysis", "Defining formulas of inorganic substances", there was considered in detail the features of the tasks solution related to chemical kinetics and chemical thermodynamics.

In accordance with the best traditions of the Kazan University teachers had a high level of interactivity, participants were interested in advanced problems that were beyond the school chemistry curriculum but can potentially appear in Olympiad tasks. The consultations on the following topics were promptly given: "Aromaticity and antiaromaticity", "Form of molecules, the concept of repulsion of valence electron pairs".

Another feature of the seminars 2015 was that final work of the participants that included the solution of chemistry Olympiad tasks. Assignments were made by the staff of Butlerov Chemistry Institute of the Kazan Federal University under the methodological requirements of the Central methodical Commission of the Russian chemistry Olympiad to the tasks of the regional stage of the

Olympiad in chemistry. It should be noted that this form of work was firstly used in the Republican courses of professional development and teachers perceived it positively. All of the participants successfully facilitated with suggested tasks.

Interacting with teachers during seminars helped to identify two of the most problematic places in the method of preparation for chemistry Olympiads, they are certain difficulties in the mastery of the materials of Olympiad tasks that stay outside of the school textbook and the low availability of tasks for the independent training of students for municipal and regional stages of all-Russian chemistry Olympiad.

The third module includes video tutorials and webinars for chemistry teachers and students jointly by the Acceptance Commission of Kazan (Volga region) Federal University aims to partially solve the above problems in the method of preparation for chemistry Olympiad.

Video tutorials and webinars can be attributed to modern interactive teaching methods. Two programs were developed for chemistry teachers and students; the first one consists of twenty lessons, the second of ten seminars. The explanations of the teacher are accompanied by a visualization of the material in various forms. Video tutorials for visualization of formulas of the substances, diagrams of chemical processes, and other important information combined with footage in the Studio of the KFU tele-centre with the performance by leading video editing and compositing. In the case of webinars, prepared by the teacher presentation on the topic was shown through software video conferencing.

In addition, video tutorials and webinars include the set of tasks, made in the form of open tests. Moreover, some of them fit the open tests, like tasks from Unified State Examination (USE) of basic challenges. The other part is an open test, similar in form to tasks of increased complexity of the exam. To accompany the distance learning we also used the classical estimated and quality tasks in the form corresponding to the tasks from exam of high complexity or tasks taken from Olympiad of the municipal and regional levels.

Solving a set of remedial worksheets, a chemistry teacher or a student can determine the true extent of their answers. The assessment of performance is done either automatically (after decision the test tasks, software remote educational technologies outputs the sum of the scores obtained for the solution of a set of tasks with indication the correct answers), or by comparing the solution to the tasks, modelling tasks of high complexity of the Unified State Examination (USE) and Olympiad tasks with author's solution.

The fourth module is methodological assistance to teachers and students of municipal districts of Tatarstan in preparation for the Unified State Examination (USE) in chemistry jointly with the Department of pre-University, General and pedagogical education of Kazan (Volga region) Federal University. It involves the publication of pedagogical materials (Gilmanshina, 2015; Gilmanshina, Sagitova et al., 2015 and etc.), special textbooks (Gilmanshina, Kuramshin, Khalikova, 2016; Gilmanshina, Kosmodemyanskaya, 2012) and regular visits of teachers Butlerov chemistry Institute to schools of Apastovsky, Kaybitsky, Kamsko-ustyinsky, Mamadyshsky, Menzelinsky districts since 2012 in the KFU team.

The fifth module integrates master-classes for solving tasks of high complexity and Olympiad tasks jointly with local educational authorities and private educational institutions of General education from municipal districts of Tatarstan.

A feature of this module is the fact that this kind of workshops are differs in high level of interactive communication teacher – students, as well as the fact that they typically held both for teachers and for students. (Teachers try to take the students who consciously involved in chemistry, potential participants of Olympiads to such activities).

Often at the beginning of such master classes, participants are offered to write a chemical dictation. Otherwise, the audience should give brief answers for 15-20 relevant questions in chemistry. Then, we analyse these questions with a discussion of related chemistry topics. The discussion of any question may take considerable time. It is obvious that the master class moderator should plan the chemical dictation in advance, to cover in the discussion as much as possible the actual complexity of topics.

It should be noted that the discussion of theoretical and practical issues related to skills is taking place much more actively when teachers and students jointly present, than there are only teachers or only in "school" audience.

System of similar master classes has been successfully implemented at the platforms of the educational institutions of municipal districts of the Republic of Tatarstan. In January 2016 the Ulyanovsk regional Department invited Professors of the Chemical Institute to conduct master classes for teachers and pupils of the Ulyanovsk region.

## **7. Conclusion**

The article reveals the content of scientific and pedagogical system of professional development of teachers of Tatarstan in their work with gifted teenagers on an example of chemistry teachers. Scientific and pedagogical support integrates five implemented autonomous modules. It is established that the innovative component of scientific and pedagogical support of the system is most fully realized in terms of the first module. It is implemented with the use of new chemical equipment, modern information and communication technologies, and combined work experience on the basis of a lyceum for talented children, unique pedagogical chemistry workshops; it is characterized by strong interactivity and performance by the students of creative project-oriented final reports.

Thus, the developed scientific and pedagogical support includes a variety of forms of professional development – both full-time and distance, focused only on teachers, and the mixed audience – the teacher plus students. All modules and forms that were described in the article differ in interactivity, they were assessed to be effective and highly valuable by the participants of refresher courses.

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