

IFTE 2016 : 2<sup>nd</sup> International Forum on Teacher Education

## Teaching Gifted Adolescents in Terms of the Transforming Natural Sciences Education

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### Abstract

<http://dx.doi.org/10.15405/epsbs.2016.07.9>

There has been a study of intellectual and academic types of gifted adolescents. The types of gifts were considered based on the following criteria: the type of activity and spheres of mentality, the degree of formation, the forms of manifestation, the levels of manifestation of various activities and its features in age development. It was found, that the giftedness - it is a multidimensional phenomenon, which is detected in the process of training and education, in the course of activities. Moreover, the information hunger gifted youth perceives painful, leading to negative reactions neurotic character. Principles of integration, interdisciplinary studies, problem and research based training are used for developing effective workability with gifted adolescents within the «school – university» system, in terms of transforming natural sciences education at Kazan (Volga region) Federal University. Long-term productive work has allowed for the allocation of various methods of teaching chemistry to gifted students. These include; IT-lyceum for gifted children, «Small Chemical Institute», the educational-methodical contest «Festival of Chemistry», practice-oriented training at the University Department of Chemical Education. In view of the results highlighted promising areas of research on methods of teaching chemistry of modern youth. It is, first of all, study the phenomenon of giftedness of the younger generation in a continuous transformation of natural sciences education.

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**Keywords:** Types of giftedness, university lyceum, transformation of education.

## 1. Introduction

### 1.1 Urgency of the problem

Nowadays the continuous transformation of education (Valeeva, 2016) and the phenomenon of gifted abilities of children (Husainova, 2016), are gaining lots of attention alongside global economic crisis (Gilmanshin, Ferenets et al., 2015), environmental problems (Gilmanshina & Gilmanshin, 2015),



and the widespread usage of information technology (Abasov & Abdullayev, 2011; Azimi, 2016). There is a growing need for the emergence of a creative and talented young generation in the fields of natural sciences and chemistry. This requires the development of new forms of education for gifted adolescents, one being the establishment of schools at universities.

### *1.2. Research problem*

The problem here is to ascertain the forms and contents of training gifted teenagers in the conditions of a transformed science education.

The aim of this research is to develop forms of teaching chemistry to gifted adolescents in a transforming natural sciences education.

## **2. Metodological framework**

The guiding principle of this research problem is the principle of integration in conjunction with the principles of interdisciplinary studies, and the principle of problem and research based learning. The principle of integration requires a well-balanced blend of modern information technology, computer-assisted technology, and traditional teaching work in the process of working with gifted adolescents. In addition, it involves the blend of multiple functions of the educational system. This principle implies the consistent interaction of these elements to improve the effectiveness of developmental education. The principle of integration establishes conditions for constant interaction between the subjects of the educational system, where stability bonds account for the effectiveness in solving common problems of developmental education.

## **3. Results**

### *3.1. Types of gifted abilities in terms of transforming education*

Currently, it is recognized that the extent of gifted abilities, is the result of a complex interaction of heredity (natural instincts) and the social and cultural sphere, mediated through work (game, education) (Belousova, 2009). There is generally no accepted systematization of the types of gifted abilities or is there a definition in literature. However, scientists distinguish between 4 and 10 types of gifted abilities.

Intellectually gifted type- is a special mental independence of intellectuals, expressed in increased critical thinking, and an ability to independently comprehend complex intellectual problems. It was identified on the basis of answers to the special IQ tests. This type proved to be ineffective for predicting future performance of an individual.

Academically gifted type implies the domination of a special ability to learn. This includes special characteristics of thinking, memory, attention, and motivation. This type is mainly exhibited by students with excellent academic achievements. Within this type, one may single out special abilities towards sciences and humanities. Modern concepts highlight several types of gifted abilities - spatial,

logical-mathematical, musical, linguistic, social and others. They were distinguished according to the following criteria; the type of activity and a sphere of mentality, the degree of formation of gifted abilities, the forms of manifestations, and the specific features of age development.

Gifted abilities involve talents in various crafts, sports, dramatics, choreography, music and arts (Development, 2003). The degree of formation of gifts allows for the differentiation between the actual and the potential kinds of gifts. The actual gift deals with achieved performance, whereas the potential one implies the unrealized potential for further high performance. Forms of manifestation are divided into obvious (manifested clearly and distinctly) and hidden (manifested in a disguised manner) forms. As for specific features of age development, they include early and late gifted abilities.

Being gifted is a multidimensional phenomenon, which is detected and studied in the process of training and education, as well as in the course of various activities. However, talented adolescents perceive the lack of information quite negatively. It is likely to lead to unfavorable reactions having neurotic characters. When considering the options for educational curriculum, it is important to highlight certain principles. These principles include; flexible contents, extensive study units, interdisciplinary studies, integration of problems and solutions, problem-based learning (Larionova, 2011).

There is a contradiction between these principles in a traditional school and a university, due to the multi-disciplinary fragmentation and the lack of meaningful interactions between disciplines. It complicates the development of the thought systems of gifted adolescents.

The important direction towards overcoming this contradiction is the transition to larger meaningful units while working with gifted young people in the «high school – university» system, in terms of a transforming higher education (Sibgatova et al., 2015). It should be based on the principles of integration, problem and research based learning (Gilmanshina & Gilmanshin et al., 2016), and the formation of the teacher's professional thinking principle (Samigullina et al., 2015; Gilmanshina S.I. & Sagitova et al., 2015).

### *3.2. Productive work formations with gifted adolescents in terms of transforming education*

Kazan (Volga region) Federal University came up with three centres for teaching chemistry to gifted adolescents: IT-lyceum for gifted children, «Small Chemical Institute», and the educational-methodical competition «Festival of Chemistry», which was arranged by the University Department of Chemical Education. The KFU IT-lyceum was opened with the initiative of the President of the Republic of Tatarstan (Rustam Minnikhanov) on September 1, 2012. The educational process commences with the 7th grade. The selection of students is carried out on a competitive basis through three levels: on-line testing, examination on the following subjects: Russian language, mathematics, reasoning capability, vocational-related subjects, and an interview based on the portfolio. IT-lyceum is a structural unit of Kazan (Volga region) Federal University, which represents a unique educational organization well-known both in Russia and abroad. The teaching staff members work according to the modern Russian, European, and Singapore teaching techniques.

In the 2013/2014 session, there was a launch of a pilot project for gifted students called «Small Chemical Institute» at Kazan Federal University. It included three additional educational programmes:

«Chemistry-9», «Chemistry-10», «Chemistry-11» (each programme lasted for 72 hours). In 2013 a total of 38 students from IT-lyceum, Lobachevsky Lyceum, Lyceums № 5, 131 (Kazan), Lyceum №1 (Zelenodolsk), Gymnasium № 7, 19, 37, 94, 122, and Schools number 39, 54, 117 (Kazan) have received certificates of completion of the corresponding educational programmes. In 2014/2015, there were a total of 46 people. In 2015/2016, priority was given to the students of IT-lyceum KFU. Structurally, «Small Chemical Institute» is a club for young chemists; preparing for the Olympics in full-time and distance modes, and a centre for project activities of students in the departments of Chemistry, named after A. M. Butlerov.

The programmes begin with the opening of the educational-methodical contest «Festival of Chemistry». It has been conducted over the past two decades by the Department of Chemical Education, with the participation of schools and lyceums. The purpose of the contest is to reward students who are talented in chemistry teaching methodology. They present various entertaining experiments to the audience. The scenario and experiments are constantly updated.

The Festival of Chemistry also has its spotlight on IT-lyceum. Despite the fact that the core discipline is computer science, IT-lyceum students show a great interest in chemistry. There is a creative chemistry team consisting of the winners of the All-Russian Olympiad, the Interregional Olympiad, the Interregional Olympiads at KFU, the All-Siberian Open Olympiad, the Regional «Young Talents» Olympiad (Perm), and the «Nobel's hopes – KNRTU» contest. A high motivation for in-depth studying of chemistry, and development of creative qualities of students were promoted by extracurricular activities of the educational and methodical contest «Festival of Chemistry» arranged by future teachers. Attending classes at «Small Chemical Institute», and the practice-oriented teaching of lyceum students at the Department of Chemical Education in Kazan Federal University, have also had a positive impact on increasing students' interest in chemistry.

#### **4. Conclusion**

The approach elaborated for teaching chemistry to gifted adolescents in terms of transforming natural sciences education, presents itself as a holistic and systematic one. It promotes motivation and creative qualities among students as well as future teachers.

#### **5. Recommendations**

The article is of practical value for school teachers, university professors, future or young teachers, and refresher course takers.

Taking into account the results of this study it is important to identify prospective areas for further consideration. They include the deepening and the extension of certain statements related to transforming education, adolescents, teachers, and transformation of chemical education.

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