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**INTEGRATIVE-INNOVATIVE APPROACH IN DETERMINING  
THE RELIABILITY OF LYCEUM GRADUATES**

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***Abstract***

Intellectual life in many respects depends on the level of professionals in all subject areas in the system of modern education. The relevance of the article is defined by the value of a pedagogical system of higher education institutions in determining the reliability of graduates of a grammar school (lyceum) for gifted students. In the article, it is specified that in this system accurate management between structures is monitored, open participation of interested persons in acceptance and implementation of the necessary and important decisions is carried out. The purpose of the article consists in the development of an integrative and innovative approach in a pedagogical system “lyceum - higher education institution”. An important characteristic of this pedagogical system is the realization of an individual choice (individual educational trajectory) of Lyceum students, preparation of bachelors and masters with a major “Chemical education” simultaneously. At the same time, there is a growing link between secondary and higher education at the Lyceum and higher professional education at the Butlerov Institute of Chemistry at Kazan Federal University. During the practical training at the Lyceum for gifted children, students (bachelors and masters) gain experience of interaction with gifted students with the help of mentors, experienced teachers and teachers who in the future become the best teachers in this field.

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**Keywords:** Individual educational route, integrative-innovative approach, university.



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## 1. Introduction

Today the most important purpose of civilization, modern, innovative society on all education levels is training of professionals of the business. Worthy elite education in lyceum – one of structures of an educational system during the work with gifted youth in a pedagogical system, allows lyceum students to have educational competence, to own intelligence, leadership. The lyceum student is obliged to be initiative, elective, flexible, responsible, tolerant, dynamic, mobile, successful and competitive is constant, anywhere and everywhere. To each lyceum student the personal individual educational trajectory (an individual chemical educational route) in development of fundamentals of science Chemistry by means of the individual program of training is built (the profile programs integrated and synchronized courses for objects of a natural-science cycle, practical works, etc.). Professionals in the subject area Chemistry, experienced teachers in the lyceum, professors from Chemical institute of A.M. Butlerov of KFU are engaged in supporting lyceum students at gaining experience of intellectual and innovative activity in chemistry during the program of training of “reliable graduates”.

When examining this problem in a pedagogical system of the lyceum and the university, it was established that in determination of reliability of the graduate of lyceum in the field of chemistry an integrated approach which consists in involvement of gifted students of profile university (bachelors and masters, also in the past engaged in chemistry competition and profound studying of chemistry) for interaction to the pedagogical practice (Hossler, 1984). Students are future teachers of chemistry, since the first course on the fourth year in a bachelor degree, on the first and second courses in a magistracy during pedagogical practice, communicate (interact) with lyceum students at the subject and personal level. Interaction of lyceum students and students during lessons, after-hour actions happens on the basis of profile and professional competences, information and communicative technologies and maybe, on this basis personal qualities are formed, the subject and personal component amplifies, there is “a complementarity moment” (a stage of mutual additions) of professional competences in the field of chemistry.

In this competency-based interaction, the complex of pedagogical conditions at the heart of which strategic, leading, universal, productive features are implemented (Furlong & Maynard, 2012). Eventually, all these form the chemical educational. Both lyceum students and students understand the purposes and values of the educational strategy of this science, being in uniform educational space, try to promote development of educational activities for chemistry, well understand the choice of intensively developing technologies for chemistry, and want to promote achievement of educational competencies in chemistry, also in the chemistry competition movement.

It is possible to note that an important characteristic of this pedagogical system is the possibility of realization of the individual choice (an individual educational trajectory) of lyceum students, training of bachelors and masters in the Chemical Education direction in parallel (at the same time) that strengthens communication between education on average and senior steps in lyceum and higher education at Chemical institute of A.M. Butlerov of KFU (Fatokun & Fatokun, 2013). Moreover, working during pedagogical practice in lyceum for gifted children, students (bachelors and masters) gain experience of interaction with exceptional children by means of mentors, experienced teachers and educator, further becoming the best teachers in this area.

Thus, in pedagogical science integrative and innovative approaches, essentially new, not characteristic of the Russian pedagogics, in determination of reliability of the graduate in the field of chemistry are formed.

In a pedagogical system of the lyceum and the university the model of the lyceum student-student-teacher at the organization of work with gifted pupils is very important in the determination of reliability of the graduate in the field of chemistry because only in interaction (matrix) of three structures “a competition component” is relevant to be entered into the individual training program of the lyceum student (Geake & Gross, 2008). At chemistry lessons lyceum students “face” non-standard tasks in chemistry which are posed by students and teachers of certain subjects at which the lyceum students “become special”, the competition chemistry helps to use and solve educational problems at formation by “the reliable graduate”. The lyceum student-student-teacher is result of interaction of a sheaf design and realization of individual educational routes of lyceum students (monitoring of results of the unified state examination, the analysis of receipt in higher educational institutions).

## **2. Problem Statement**

The issues are considered in the field of personal focused education (Bondarevskaya, 2000; Shchurkova, 2002; Asmolov, 2007). Authors discussed the originality of the purposes and tasks of modern school; an opportunity for modeling the worthy level of quality of education with creation of scientifically based models of the graduate; updating of school programs taking into account opportunities of school and real life. However, studying of psychology and pedagogical literature allows to state lack of the special researches devoted to a problem of reliability of the graduate of lyceum for exceptional children as result of integrative and innovative approach in a pedagogical system of the lyceum and the higher education institution.

## **3. Research Questions**

In the pedagogical system of the Lyceum-University is very important link Lyceum student-teacher in the organization of work with gifted students, in determining the reliability of the graduate in the field of chemistry, because only in the interaction (matrix) of the three structures becomes relevant introduced into the individual curriculum of the Lyceum “Olympiad component”. At each lesson of chemistry Lyceum students “face” with non-standard tasks in chemistry, which are composed by students and teachers on certain topics, in solving which Lyceum students “become special”, because Olympiad chemistry helps to use and solve educational problems in becoming a “reliable graduate”. The result of interaction between the Lyceum student-teacher is the design and implementation of individual educational routes of Lyceum students (monitoring the results of the unified state exam, the analysis of admission to higher education institutions).

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

Scientific substantiation and development of integrative-innovative approach to determine the reliability of the Lyceum graduate for gifted children in the pedagogical system of the Lyceum-

University. The objectives of the study are: to conduct a literary review of the existing methodological approaches in the psychological and pedagogical scientific literature on the research topic; to develop a plan of interaction between Lyceum students (bachelors and masters) and teachers; to create innovative complexes in the field of chemical education; design and implementation of individual routes of Lyceum students (monitoring the results of the unified state exam, analysis of admission to higher education, competitiveness).

## 5. Research Methods

Research methods used:

- *theoretical*: the analysis of philosophical, psychological, pedagogical, sociological literature, publications on a research subject; studying of program and methodical literature, normative documents;
- *empirical*: diagnostic (testing, generalization of independent characteristics, rating assessment); polling methods (questioning, conversation, interview); direct and indirect pedagogical observation;
- *predictive* (the comparative and comparative analysis, design);
- *experimental* (stating, didactic, total);
- *statistical*: statistical and analytical data processing of an experiment.

The experimental base of the research was the boarding school IT-lyceum of Kazan Federal University. For only 3 years from 2015 to 2018, including survey, the research captured 150 lyceum students, including 27 students from groups of a chemical and biological profile became direct participants of an experiment.

### 5.1. Investigation phases

According to the research logic, experimental work was carried out in three steps. During the first stage (2014-2015) the literary review of the existing methodological approaches in psychological and pedagogical scientific literature was conducted; identification of contradictions, definition of a problem, purpose; studying of psychology and pedagogical and scientific and methodical literature on a research subject were performed.

The second stage (2015-2017) included the development of theoretical base of a research, pedagogical conditions; creation of a databank of chemistry competition tasks; development of the plan of interaction of lyceum students, students (bachelors and masters) and teachers; design and realization of individual routes of lyceum students (monitoring of results of the unified state examination, the analysis of receipt in higher educational institutions, competitiveness); the organization and carrying out didactic and total stages of a pilot study for the purpose of check of a hypothesis of a research.

The third stage (2017-2018) involved the creation of innovative complexes in the sphere of chemical education, statistical processing and generalization of results of experimental work, correcting of individual training programs, a formulation of the main conclusions and methodical recommendations.

## 6. Findings

### 6.1. Structure and content of the approach

In a pedagogical system of the lyceum and the university at the organization of the work with gifted students who are future reliable graduates of the lyceum in subject area chemistry, integrative and innovative approaches are developed. It is established that in the determination of reliability of the graduate of lyceum in the field of chemistry an integrated approach which consisted in the involvement of gifted students of profile higher education institution during pedagogical practice teaching for interaction subject and personal level with students and teachers of lyceum was used. Interaction of lyceum students and university students is proved during lessons, after-class hours on the basis of profile and professional competences, information and communicative technologies. It is specified that at the same time personal qualities of pupils and students in the subject and personal level of the competence-based interaction were created on the basis of which the complex of pedagogical conditions for formation of continuity was developed which led to further chemical educational integration. It is noted that understanding of the purpose and values of the educational strategy of chemistry in uniform educational space for the achievement of educational competency in this subject was lyceum students and students. The interaction matrix “lyceum student-student-teacher” in a pedagogical system “the lyceum and university” on the basis of integrative and innovative approach gives the chance to define (to predict) reliability of the graduate in the field of chemistry which is proved by design and realization of individual educational routes of lyceum students on a profile chemistry.

### 6.2. Development stages and introductions of approach

Development and deployment of this approach assumed carrying out the following stages of experimental work.

#### *The stating stage*

In a pedagogical system the lyceum and university at the organization of work with gifted students, when developing integrative and innovative approach, at an interaction matrix “lyceum student-student-teacher”, when determining reliability of the graduate in the field of chemistry, the following actions were planned:

- to project and realize individual chemical educational routes of lyceum students;
- to cooperate during creation of innovative complexes in the sphere of chemical education with higher education institutions;
- to participate in computerization of chemical education;
- it is wide to use remote, online courses during the work with exceptional children;
- to reveal, motivate and accompany students in the chemistry competition movement;
- to operate technologies of design and research training in the field of chemistry;
- to prepare lyceum students for a State Final Examination (the main state exam (MSE), the unified state examination (USE));
- monitoring of passing the unified state examination in chemistry;

- to use a portfolio (the lyceum student, the student, the teacher) as the accumulative system of personal achievements in a subject chemistry, also as the instrument of monitoring and diagnostics (Khalikova, 2018);
- to analyze arrival of graduates in higher educational institutions on a profile.

**Table 01.** Comparative results of the unified state examination in 2016

Subject	Quantity participants of the USE	Points 80-100	GPA 2016		
			Lyceum	City	Republic
Chemistry	8	2	73	60.0	59.3

Comparative results of the unified state examination in 2016 (Table 1) show that GPA on lyceum not really high, only two students passed examination with high scores of 80 and 100 (21%).

*Didactic stage*

At this stage in a pedagogical system, the lyceum and university in definition and forecasting of reliability of the graduate of lyceum entered into the individual training program of the lyceum student in chemistry “a competition component”. That is why there was work on the creation of a databank on competition tasks on chemistry of district, regional and final stages of the chemistry competition. Also, tasks from the archive of the competition are used; the author's tasks in inorganic and organic chemistry were made. The plan of the interaction of lyceum students, students (bachelors and masters) and teachers of chemistry is developed for the realization of “a competition component” at chemistry lessons by drawing up the working program in chemistry. On everyone a chemistry lesson student "faced" non-standard tasks in chemistry at which solution "became special", the work providing formation and support of the individual educational program in the chemical educational environment was organized. The design stage and realization of individual educational routes of each lyceum student in chemistry by means of “a competition component” which was followed by monitoring of results of the unified state examination and the analysis of receipt in higher educational institutions began.

**Table 02.** Comparative results of the unified state examination in 2017

Subject	Quantity participants of the USE	Points 80-100	GPA 2017		
			Lyceum	City	Republic
Chemistry	7	6	87.1	63.32	63.2

Comparative results of the unified state examination in 2017 (table 2) show that the GPA on lyceum became 14.1 units higher (high), six students passed examination for high point from 80 to 100 (85%).

*Total stage*

This stage was followed by the creation of innovative complexes in the sphere of chemical education, there was close cooperation with Chemical institute of A.M. Butlerov, students and lyceum students participated in computerization of chemical education, operated technologies of design and research training in the field of chemistry. In these conditions, there was a training of students for a State Final Examination for the unified state examination in chemistry (Khalikova & Khalikov, 2017).

At identification, the motivation of students to engage in the chemistry online courses was high. The saturated educational space for lyceum students was created on the basis of the integrative and innovative approaches, at realization of an individual educational route of each student. The educational environment was created as the educational process of preparation for chemistry competitions (including target, substantial and organizational components); professional and pedagogical activity of teachers of chemistry; pedagogical practice of students of bachelor's and master's degrees; interaction (matrix) of lyceum with the external environment (KFU, NSU, the CCGT) in the organization and carrying out the list frames of the in chemistry competition (Gilmanshina & Khalikova, 2015).

Under such circumstances, the level of achievements of reliable graduates in the area chemistry is connected with the educational result on the chemistry profile. Level of education of lyceum graduates (a victory at the competitions, challenges; successful passing the unified state examination, entering a higher education institution) is considered the main educational result on chemistry and also gives justification to consider that, thereby, the possibility of definition and forecasting of reliability of the graduate of lyceum increases (Khalikova, 2018). It is used as a portfolio (the lyceum student, the student, the teacher) and as the accumulative system of personal achievements in subject chemistry, also as the instrument of monitoring and diagnostics. The analysis by results of passing the unified state examination and to arrival of graduates of lyceum in higher educational institutions of the Republic of Tatarstan and Russia was made.

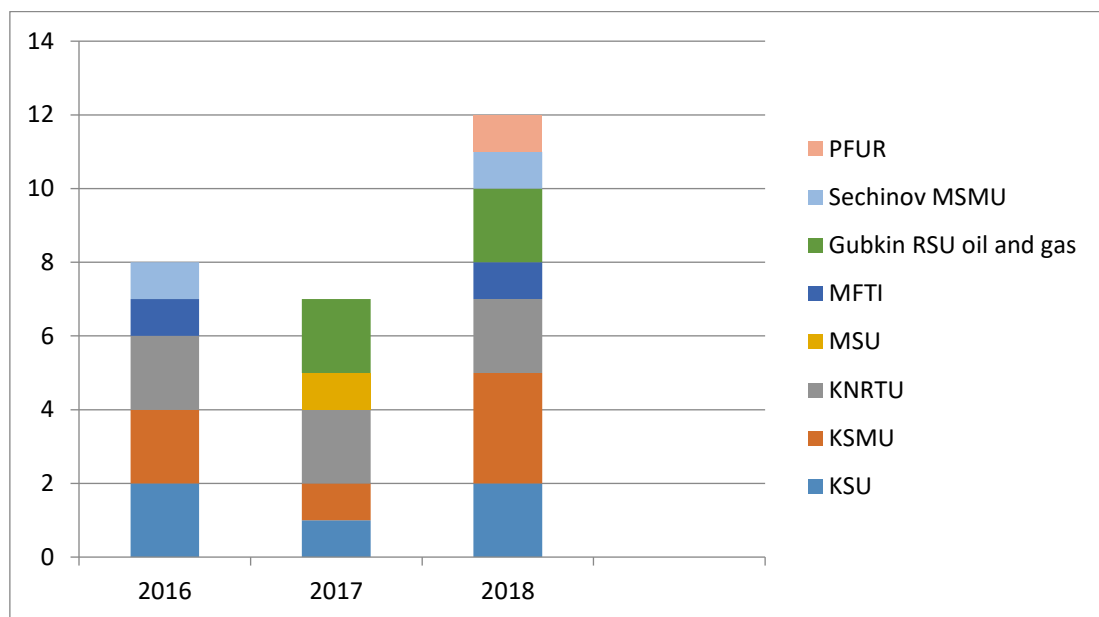
**Table 03.** Comparative results of the unified state examination in 2018

Subject	Quantity participants of the USE	Points 80-100	GPA 2018		
			Lyceum	City	Republic
Chemistry	12	9	85.75	65.74	64.63

Comparative results of the unified state examination in 2018 (table 3) show that more students chose examination (from 7 to 12) the GPA on lyceum became steadily high, nine students passed examination for high point from 80 to 100 (75%).

**Table 04.** Receipt in higher educational institutions of the Republic of Tatarstan and Russia

Universities	2016	2017	2018
KSU	2	1	2
KSMU	2	1	3
KNRTU	2	2	2
MSU		1	-
MFTI	1	-	1
RSU	-	2	2
MSMU	1	-	1
PFUR	-	-	1



**Figure 01.** Higher educational institutions of the Republic of Tatarstan and Russia

Comparative results of receipt in higher educational institutions of the Republic of Tatarstan and Russia from the 2016th to the 2018th year show (Table 4, Figure 1) that graduates of lyceum go to the prestigious universities on profile chemistry.

## 7. Conclusion

The graduate of the lyceum for gifted children in a pedagogical system of the lyceum and the higher education institution has personal educational potential and provides himself with an opportunity to continue further education competing with strong students in a higher educational institution in the subject area of chemistry. It is established that the graduate of the lyceum in a pedagogical system of the lyceum and the higher education institution besides personal educational potential has such quality as reliability. It is the strong knowledge gained by the lyceum student which remains for long; secondly, aspiration to self-development, acquisition of new knowledge; thirdly, adapting in new educational conditions (the new chemical educational environment), positively influences its development. The ability of the graduate to withdraw the mistakes can be considered as the criteria of reliability and as an opportunity for self-development during life, the correct assessment of various life situations, etc. It is interesting that at the same time there is still the projection of reliability of the graduate of the lyceum in a system the lyceum and the higher education institution on reliability of quality of education of graduates of all other graduates in a class.

Competitiveness of graduates determines the best universities of Russia which graduates successfully go to. Summarizing the aforesaid, it is possible to claim that the role of a pedagogical system of the lyceum and the higher education institution in determination of reliability of the graduate of the lyceum is invaluable because at the same time there is a tracking of accurate management between structures, implementation of broad participation of interested persons in acceptance and implementation of the necessary and important decisions on the basis of integrative and innovative approach.



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