Results of the Experimental Research on the Introduction of Information and Telecommunication Technologies in Teacher’s Professional Training

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Abstract

Today in the Republic of Kazakhstan much attention is paid to the introduction of information and telecommunication technologies in all spheres of social life. At the same time, the requirements presented by the society for the future teacher’s training, the level of information competence, personal and social qualities became higher. The widespread introduction of information and telecommunication technologies in educational process is one of the priorities in the development of the national higher education system. This is determined by the large-scale informatization and computerization of education and all spheres of social life. The article describes professional training of future chemistry teachers from the standpoint of information competence formation and discloses a system of the future chemistry teacher’s professional training to work in conditions of the education informatization.

Keywords: Future Teacher, Information Competence, Information and Telecommunication Technology, Training

1. Introduction

New realities caused by the process of education globalization and informatization set new tasks and generate new contradictions in the functioning of the higher education system. Since the Republic of Kazakhstan has joined to the Bologna Process, Kazakhstan high schools are aiming to provide training of highly qualified teachers and education quality management as one of the most pressing problems in the higher education modernization. The Bologna Process initiated transition from formal knowledge to competency-based paradigm in the higher education system.

Traditionally, the ultimate goal of the future teacher’s training in the higher educational institutions is determined by the needs of the society, social order and the level of education and technology development. In conditions of global informatization of science and practice, employers need not just a qualification, which has traditionally been associated with the ability to perform certain operations, but competence, which combines qualification, in the strict meaning of the word, an active ability to efficiently use information resources and social behavior, an ability to work in a group, and initiative.

In all spheres of modern society, including education, in the age of rapidly developing Information and Telecommunication Technologies (ITT) such a phenomenon as information incompetence, primarily manifested as an inability to solve new problems, is becoming more typical. Finding ways to bridge the gap between accumulated traditional human experience and the requirements of the rapidly changing real life is the most urgent problem of the modern time.

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In this regard the question about what kind of education we should have in the new millennium arises more acutely. Today, the international community is focused on competence, an ability to think in a creative way and act independently. It is evident that the information culture must become an integral part of a person's general culture, due to the increased importance of information resources of the society. Therefore, the education system sets the task of creating a unified information and educational space, managed by unified generated concepts, approaches and mechanisms of implementing the overall strategy in formation, development and achievement of the goals of increasing the cultural, educational and professional level of the subjects.

The Education Law of the Republic of Kazakhstan stated that the modernization of higher education as a basic level of education assumes the orientation of education not only to assimilation of certain amount of knowledge by students, but also to the development of their personality, cognitive and creative abilities. In the new educational standards of basic education the acquisition of general skills and ways of activity (cognitive, information-communicative and reflexive) as essential elements of culture stands out as the necessary condition for development and socialization of students in the modern world. Based on our study, we can say that the important goal of high schools is to ensure self-realization and personal development of students, their quick adaptation to dynamically changing conditions of the society.

Any changes in the higher education structure have an impact on the formation of social order of the society to teacher training. Social and economic requirements of the society to a modern chemistry teacher in the context of informatization and computerization of education cover development of appropriate professional knowledge, skills, teacher's readiness to use new information technologies in teaching and, consequently, to the formation of professional qualities, as well as information competence.

A teacher who is going to use the whole range of information telecommunication technologies in the educational process, should have a high level of training in the field of computer science, otherwise it is impossible to exploit the information technologies and implement their potential for educational purposes. It should also be noted that future chemistry teachers should have necessary methodological knowledge for effective implementation of all functions related to the use of information technologies. Teacher’s knowledge and skills in the ITT use in education should be considered as an element of professional teaching skills. There is no doubt that pedagogical universities should play a major role in solving this problem.

The issues of theory and practice of chemistry teachers training at universities have been addressed by the leading scientists and methodologists: NE Kuznetsova, EV Beresneva, MS Pak, OS Zaitsev, Majid Ebrahim Damavandi, AA Belokhvostov, EE Minchenkov, PI Bespalov. The problems of future teacher’s training in the use of information and telecommunication technologies were studied by A Seda Yücel, KM Berkimbayev, Miri Barak, Qing Zhou, Y Masuda, MM North, ES Polat, VV Grinshkun, NI Pak and others. The analysis of the research, which represents various aspects and problems with regards to inclusion of information technologies in the teaching process, showed that fundamental restructuring of the content and technology of higher pedagogical education is required.

### 1.1 Relevance of the Study

At present, more and more attention is paid to the problem of providing education by methodology and practice of development and optimal use of modern Information and Telecommunication Technologies (ITT), focused on implementation of psychological and pedagogical aims of training and education. The issue of increasing expertise of chemistry teachers in mastering the technique of the ITT application in their subject area acquires a particular importance, as a result, teacher’s new professionally-relevant personality is developed and their intellectual capacity and competitiveness get improved. In the new information environment the information competence, by which we mean a systemic quality of personality represented by an ordered set of competences in the field of chemistry and ITT, should become an integral part of professional competence of future chemistry teachers.

Professional Competence is readiness and ability to act helpfully in accordance with the requirements of the case, to solve problems and challenges methodically organized and independently, as well as independently to assess the work results. In other words, it includes the subject skills, appropriate methods and techniques inherent in the subjects.
The professional competence is considered as an integral characteristic of specialist's business and personal qualities, which reflects the level of knowledge, skills, experience sufficient to produce a certain kind of activity that is related to decision-making.

The professional competence of the future chemistry teachers is a multifactorial phenomenon including the teacher's theoretical knowledge system and methods of such knowledge application in specific teaching situations, the teacher's value orientation, as well as their culture integrative indicators (speech, communication styles, attitude to themselves and their activities, to the related fields of expertise, etc.)

Based on the analysis of research it has been identified that professional competence includes a key, basic and special competence. All three types of competencies are interrelated. They form the individual style of pedagogical activity, create a complete image of a specialist and ultimately ensure the formation of his professional competence as a certain integrity, as an integrative personality characteristics.

That's why professional competence of the future chemistry teachers shall be formed in such a logical sequence:

• The first stage is focused on the key competences formation in the context of the future professional activity.
• During the second stage the learner is “immersed” in the professional cases, learns the methods of their solving. This facilitates the formation of the basic competence.
• The third stage is the formation of the specific competence.

The basic competences must reflect the modern understanding of the main goals of professional activity and the key ones must reflect the ways of their solving. The specific competences realize the basic and the key ones according to the professional pedagogical activity peculiarities of a certain specialist.

In the key competences, we include the informational competence, which is based on the universal ability to work with different information sources and which envisages the pre-professional and social mobility of the person. The content of the universal skills, which belong to the information competence, varies according to the age peculiarities of the person and the circle of vital problems to be solved. Mastering of the information competence is connected, firstly with the extension of the information sources amount and secondly, it's connected with the extension of the amount of necessary skills.

Thus, the training of future chemistry teachers for ITT usage mitigates the formation of their key, basic and specific competences.

Information and Telecommunication Technologies (ITT) is a common definition, describing different methods, ways and algorithms of information collecting, storing, processing, and representation.

According to many specialists, on the modern stage of professional education development the ITT usage gives the opportunity to:

• Build an open education system, which will provide each individual with his / her own learning path.
• Change drastically the cognition process structure due to its deflection to the methods of systemic creative thinking.
• Create an effective management system for the information and methodological support of education.
• Organize rationally the cognitive activity of the learners during the learning process.
• Use specific features of the computer, which will help to personalize the learning process and then address to the totally new cognition means.
• Build, develop and master the system of different levels of remote learning.
• The ITT provides the opportunity to solve the following didactic tasks of the professional education.
• Based on the usage of computer graphic means and computer modeling to learn the phenomena and processed in various systems of professional activity.
• On a convenient learning scale to represent different processes, which are progressing with a very high or low speed.

It should be mentioned as well that the ITT usage during the process of the education computerization provides the following opportunities: The implementation of the ITT means in the education process, the increase of the computer (information) training of the future teachers. The systemic integration of the telecommunication and informational technologies, supporting the scientific researches, the educational processes and structure management. The settling and development of a united educational and informational space.

The ITT usage during the process of future teacher's informational competence formation undoubtedly has a potential as one of the means, transforming the teaching of professional skills into the creative process.

The competent ITT usage provides the possibility...
to realize a totally new approach to the informational competence formation that will give future chemistry teachers the opportunity during the further professional activity.

That's why, the only condition for the ITT to be effective in the educational process is the one when they do not adapt to the existing education system, but when they enter it as an element of a new educational system, thus favouring the realization, preservation and the development of individual talents of the learners. The formation of the learner's cognitive skills, the desire for self-perfection; the provision of the complexity of studying the reality phenomena, indissolubility of interconnection between natural sciences and engineering, constant and dynamic updating of the content, forms and methods of the processes of educating and upbringing.

The results of our experimental and analytical research on the level of training of future chemistry teachers in the conditions of education informatization, the theoretical analysis of a variety of literary sources (monographs, dissertations, articles, tutorials, regulatory documents) revealed that most chemistry teachers were not ready enough to use new information and telecommunication technologies in the educational process. This is due to the following:

1. Lack of specially organized system in universities for training future chemistry teachers to the ITT use in teaching chemistry,
2. Low computer literacy of teachers,
3. Ignorance of the ITT didactic possibilities and weak mastery of the technique to apply them in the educational process and
4. Insufficient material and technical base of the educational process, both at school and university.

The foregoing confirms the existence of objective contradictions between the actual requirements for teachers training level in the use of information and telecommunication technologies in the educational process and the reality, between the need for meaningful and technological integrity of the professional training system in universities and fragmentation of the content of educational programs. Therefore, one of the priorities is to form professional readiness of the future teachers to master the methodological support of educational process and technology of education informatization in their subject area. Moreover, universities should provide reliable training for students in the use of information and telecommunication technologies, adequate to the growing process of informatization of society in general.

One of the possible solutions to this problem is to ensure the functioning of the university methodical system of formation of future chemistry teacher's information competence, which integrates special, informational, psychological and pedagogical training of the graduates and is a component of a more complex system of complete professional and pedagogical competence.

The subject of the research is the process of formation of future chemistry teacher's information competence in higher educational institutions.

1.2 The Aim of the Research

Is to develop a methodical system in the future chemistry teacher's training in the conditions of education informatization, the theoretical justification of its necessity, and the identification of conditions ensuring its effectiveness.

1.3 The Objectives of the Study Include

- Theoretical study of the problems in the training of future chemistry teachers in conditions of education informatization.
- Development of a methodical system of future chemistry teacher's training in conditions of education informatization.
- Experimental verification of the effectiveness of the elaborated methodical system, ensuring the development of abilities of future chemistry teachers to use ITT in professional activities in the context of the information competence formation.

1.4 The Research Methods

The main research methods are the theoretical analysis and design, the correlation and generalization, modeling the studying of the future chemistry teacher's professional activity experience, observation. During the investigations, we used the following methods of scientific research in order to solve the set tasks and to verify the initial assumptions: General-logical methods, including the analysis of the philosophic, psychological, pedagogical, regulatory and other literature devoted to the problems of the professional education and community computerization, synthesis, abstraction, analogy, statistical methods with the graphic representation of the results). The methods of empirical cognition (formalization, deduction, the transition from abstract ideas to concrete ones). The methods of empirical research (observation, surveying, the experiment in natural conditions, correlation, description, monitoring and measuring). The systemic approach to pedagogical
and logical analysis performance, the generalization and analysis of the pedagogical experience. Modeling of the system structure and content for the future chemistry teacher's preparation to the ITT usage during their pedagogical activity. We have developed the methodology of experimental work, specified the rates and criteria of evaluation for this technology efficiency during the information competence formation. We have performed the pedagogical experiment and developed the academic maintenance of the educational process, aimed at formation of the informational competence of the future chemistry teachers during their training.

In modern pedagogical literature two terms are used–‘competence’ and ‘competency’ that correspond to the English word ‘competence’. Although these terms are close, they are not identical in nature. Khutorskoy AV divides them as follows: Competence means the collection of related personality traits (knowledge, skills, ways of activity) relative to a range of subjects and processes necessary for high-quality productive activities. Competency means the possession of appropriate competence by persons, including their personal relation to it, and to the object of activity.

In the educational standard of the first stage higher education for the major discipline “5V011200-Chemistry” the following definitions are given: Competence is the knowledge, skills, experience and personal qualities required to solve theoretical and practical problems, competency is an expressed ability to use knowledge and skills.

In the information society another important component has been added to professionally relevant knowledge, skills, qualities and abilities of teachers, their information competence. Thus each stage of informatization puts forward new competence requirements of teaching profession.

Based on the research works of scientists we can talk about “informational competences of teachers being new objective requirements for their professional skills and teacher’s informational competency being their personal professional portfolio”.

Based on the analysis of scientists, the information competence of chemistry teachers means their readiness to widespread application of information and communication technologies in all kinds of professional pedagogical activity.

We can distinguish three main components in the structure of information competency of a future chemistry teacher, formed while studying at the university:

- Basic (information and computer)
- Objective and Methodical (chemical and methodical).
- Objective and Specific (chemical).

The basic (information and computer) component is the basis of information competence of a future chemistry teacher. In meaningful aspect it includes knowledge, skills and experience in the use of computer technology as a means of obtaining, transmitting, storing and using information that, as a matter of fact, describes the concept of “computer literacy”.

The objective and specific (chemical) component of information competence is formed when students are studying chemical disciplines. It is based on the use of ICT in knowledge of chemistry basics in the context of future professional activity and includes theoretical and methodological, pedagogical context and specialized computer components.

The objective and methodical (chemical and methodical) component of information competence is formed by students when studying university courses in methods of chemistry teaching and chemical methodological courses based on previous psychological and pedagogical training. It is aimed at developing methodologies for the use of electronic media and ITT in professional activities of a chemistry teacher and includes general methodological and special methodological components.

The general methodological component is determined by the goals and objectives of the university courses in chemistry teaching methods registered in the model program. The point of this discipline is the formation of practice oriented knowledge and skills system in students, professional competence of a chemistry teacher, training for practical activities in the national education system.

One of the possible ways of formation of the information competence of a future chemistry teacher is to ensure the functioning of a particular system, the essential function of which is to provide organization, management and ordering of all components of the learning process associated with informatization of chemistry and pedagogical education. It allows running certain integral process involving disciplines of different blocks and loops, providing a high-quality organic integrity of the system of future chemistry teachers training at the university. Experimental work on the formation of information competence of future chemistry teachers was carried out on the basis of The International
Kazakh and Turkish University named after Yasawi Kh. A., on the basis of The South Kazakhstan State University named after Auezov M. and The Moscow City Pedagogical University.

2. Methods

During the design of higher educational establishment educational process teachers must take into account the variety of methodological approaches that alter perception, understanding of the world, thinking of the future teacher of the 21st century and the impact on their professional activities. Reliance on methodological approaches contributes to the formation of a higher level of informational competence of the future teachers of chemistry, based on the use of information and telecommunication technologies during learning chemistry. The approach as such includes the method. Except for method the usability is defined by the axiomatic and target features, which are set when the researcher starts the interaction with the chosen object. The orientation of different methods may also be realized in its relation to a certain object, and thus simultaneously form different types of practice in it, which then provoke the situation of plurality of the object forms existence.

In our research we have tried to consider a certain amount of methodological approaches being present in pedagogy: Systemic one, competence, integrative, activity-personal, culturological.

Systemic approach ensures the integrity of future chemistry teacher's methodical preparation system and the ITT use in their future career. This is accomplished through a phased system of informational competence formation in all organizational forms of the future chemistry teacher's training (lectures, seminars, practical and laboratory studies, independent work of students).

Competence approach ensures the formation of the most important competences in student's minds, the degree of mastery of which characterizes the level of information competence as readiness for practical use of ITT means in the future professional activity.

Integrative approach reflects the leading trend of development of modern science and education and involves the establishment of intra- and interdisciplinary connections, as well as integration mechanisms.

Activity-personal approach puts the student's personality at the center of the educational process and predefines the creation of conditions for the development of their skills and opportunities, for self-realization, the disclosure of the individuality during the course of career. That is why the activity of the future chemistry teacher connected with the use of ITT in education is a system-forming component of their methodical preparation.

Cultural approach ensures the formation of the student's information culture, which should be understood as a person's ability to understand and master the picture of the world as a system of symbols and signs, forward and backward links and to orient freely in the information society, to adapt to it easily.

A special role in the formation of the content of information competence was assigned to the following principles: Didactic and resource availability, systematocity, integrativeness, multi-functionality, comprehensive and practical orientation. Let us consider each of them.

2.1 The Principle of the Didactic and Resource Availability

Didactic availability determines the level of student's training, the level of their basic and subject-specific information competence. The resource one includes student's work with computer programs, freely distributed and not requiring significant financial cost to purchase them.

2.2 Systemic Principle

Are accordingly the goals, forms and methods of teaching, learning tools and evaluation of the results.

2.3 The Principle of Integrity

Is based on setting the connections between psychological and pedagogical, basic chemical and chemical-methodological disciplines, during which the integrative basis of their information competence is formed.

2.4 The Principle of Practical Orientation

The formation of student's methodological skills that is necessary in a practical implementation of the basic ideas of chemical education computerization at the present stage.

Implementation procedure for the formation of the chemistry future teacher's informational competence states that the working methods have been focused on the usage of educational material as a source for independent problem solution search.

The usage of ITT means provides certain specificity to traditional methods of educating.
2.5 Explanatory-Illustrative Methods

Involve the obtainment and reproduction of the “ready” knowledge by students. So, explanatory-illustrative methods of teaching chemistry, including the usage of the interactive blackboard and a multimedia projector can significantly improve cognitive activity of the students by increasing the visibility and emotional intensity (animation, sound, video and other multimedia effects).

The ITT usage opens wide opportunities in organization of chemistry learning with the help of heuristic and research methods of learning (Internet-projects, scientific theses, virtual chemical labs). In this approach the activity of teacher and students is based on the complex of actions: 1. The creation of problematic situation. 2. Clear definition of the problem. 3. Creation of hypothesis. 4. Problem solving. 5. Drawing the conclusions. The actions of the students and the teacher may be represented differently at different stages of the learning process. The research activity gives the opportunity to develop the cognitive activity of the learners, teaches them to work with the literature, e-books, and forms the skills of searching for the chemistry information in the Internet. The results of the learner’s study are executed in the form of presentations, which will be demonstrated during conferences, seminars etc.

Special attention is paid to the methods of computer teaching, such as computer modeling of the chemical objects and processes, learner’s virtual chemistry room, work with the educational programs on chemistry in order to form the future chemistry teacher’s informational competence on the basis of using information and telecommunication technologies.

The methods of ITT usage in chemistry are focused on the learning process mastering, the deepening and extending of knowledge in chemistry, forming of the teacher’s informational competence.

3. Results and Discussion

The present article includes the results obtained in the course of collecting and analyzing the empirical data concerning the problems in the use of ITT tools by teachers, the data obtained while testing the methodical system of training teachers to use means of information and telecommunication technologies in professional activity, the results of verifying the efficiency of the developed methodical system using methods of mathematical statistics.

We carried out the experimental work in three stages (ascertaining experiment, search experiment, forming (training) experiment. Thus, the following tasks were solved:

- Assessment of the difficulties and problems encountered by teachers in the use of information and telecommunication technologies in professional activity and their causes.
- Development of training and methodological support for experimental learning and its introduction into the educational process.
- Verification of the effectiveness of the developed methodical system, ensuring the development of future teacher’s abilities to use information and communication technologies at different levels of regulation of professional activity.

The ascertaining retrieval stage was dedicated to the development of the general concept of the research based on the analysis of pedagogical, psychological and methodological literature. We have examined the state of the problem and the peculiarities of teaching experience and formulated a working hypothesis and conducted the ascertaining experiment.

In the course of the ascertaining experiment the authors conducted the following:
1. The analysis of scientific papers on the problems of the application of information and telecommunication technologies in the chemical education, the informatization of special training for chemistry teachers in a higher educational institution.
2. The study of the attitude of chemistry students to the problem of chemical education informatization.
3. The study of the information competence of teachers and future chemistry teachers.
4. Pedagogic observation and analysis of studies on chemical disciplines in higher education institutions in order to learn the experience of the ITT application and monitor their effectiveness in training.
5. The analysis of the content of programs on special and general professional disciplines of the curriculum in order to determine the necessity of the formation of the student’s information competence.

In our study we presented the results of the experimental work on the formation of information competence of future chemistry teachers. In the result of questioning, it became known that 83% of all the respondents were familiar with the informatization tools and information and telecommunication technologies. This indicates the involvement of ITT tools in the interests of the respondents. Upon personal interviews
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and the results of questionnaires we have established that respondents had an idea about computers and information and telecommunication technologies, but in the responses to the questionnaire some of respondents were not convinced of the necessity of their use in chemistry teaching. 79% of the respondents were convinced of the necessity to apply ITT in chemistry teaching in Figure 1. The ratio of respondents according to the degree of familiarity and the necessity of the use of the informatization tools and information and communication technologies.

![Figure 1](image1.png)

**Figure 1.** The ratio of respondents according to the degree of familiarity and the necessity of the use of the informatization tools and information and communication technologies.

These results show the interest of students in training to use information and telecommunication technologies.

According to the majority of respondents, the reason for the lack of the use of information and communication technologies in chemistry teaching is the lack of knowledge of the method of using information and telecommunication technologies in teacher training in Figure 2.

![Figure 2](image2.png)

**Figure 2.** Reasons for the low level of the information competence of future chemistry teachers.

Following the revealed reasons, the experimental work on the methodical system of future chemistry teacher’s information competence formation has been conducted. Methodological foundations of the information competence and methods for diagnostics of its effectiveness have been developed. An additional elective course is required for the implementation of the integrated methodological training of future chemistry teachers for the work in the conditions of the education informatization. On this basis, the introduction of the elective course “Methods of chemistry teaching on the basis of information-telecommunication technologies” to the bachelor-level program on the major discipline “Chemistry” (No. 5B011200) is considered of high relevance. At this stage a manual “Methods of chemistry teaching (on the basis of information and telecommunication technologies)” for the elective course “Methods of chemistry teaching on the basis of information and telecommunication technologies”, electronic textbooks for the course “Inorganic chemistry” and “Descriptive chemistry” have been published.

The elective course is a systemically important component in the integrated system of future chemistry teacher’s training to the ITT application in the context of fundamentalization of their education and serves as the practice-oriented subject. This course is organically integrated into the paradigm of learner-centered education of chemistry teachers and in accordance with the principle of cultural conformity, it helps to educate a teacher as a person possessing chemical, pedagogical, methodological, information culture. The elective course “Methods of chemistry teaching on the basis of information and telecommunication technologies” is characterized by a high level of creativity, which is due to its innovative nature and the system of individual professionally-oriented creative tasks.

It is necessary to focus on methodological issues of using information and telecommunication technologies in teaching. Students should be trained to use and analyze existing training programs. It must be realized that due to the rapid development of modern computer facilities, telecommunication and software facilities only professionals must technically develop training programs. Teachers themselves due to the specifics of their activities do not have a possibility and a necessary training level in order to create programs for educational purposes. In our opinion, teacher’s main task is to apply ready-to-use educational programs, if necessary adapting them to achieve their own teaching purposes. Provide
methodological quality assessment of existing software products. Serve as consultants in the development of training programs.

The elective course includes a series of psychopedagogical and methodological issues, learning the content of which enables future teachers to effectively organize a computerized pedagogical process.

The program of the elective course “Methods of chemistry teaching on the basis of information and telecommunication technologies” has been developed with due regard to the requirements of GOSO RK as of 2010.

The main goal of the elective course is to develop the information competence of the future chemistry teacher. In accordance with this, the course is assigned to solve the following main tasks:

- To promote awareness of the changes in education goals, shifting emphasis from the “acquisition of knowledge” on the formation of the student’s competencies.
- To educate future chemistry teachers to rationally use educational technologies aimed at forming the abilities to carry out various types of self-study on the collection, processing, storage, transfer, production of the educational information in the professional activity of a chemistry teacher working in the education system.
- To familiarize future chemistry teachers with modern techniques and methods of using information and telecommunication technologies when carrying out various activities in different types of learning activities.
- To train teachers to organize and conduct methodically competent lessons in terms of the wide use of information technologies in the educational process.
- To familiarize future chemistry teachers with methods of using information technologies.
- To teach future teachers to make a quality assessment of specific software tools for educational purposes for conducting chemistry lessons.
- To teach the creation of a package of educational materials capable of activating the student’s work, disclose their imagination and creativity, and thus contribute to the development of modern information and telecommunication technologies.
- To develop the creative potential of a future chemistry teacher required for further self-study, self-development and self-realization in the rapid development and improvement of information and telecommunication technologies.

The effectiveness of the elective course was checked during the formative experiment. The main goal of the formative experiment on the introduction of the course of methods of ITT application in chemistry teaching into the educational process was to test the hypothesis on its effectiveness in the formation of the information competence of the future chemistry teacher. For the achievement of this goal it was necessary to solve the following tasks:

1. To teach students to effectively apply ITT in the learning process on chemistry lessons.
2. To ensure a high growth rate of the student’s information competence for the experimental period.
3. To show that the system of training the students of the experimental group significantly differs from the system of training control groups and these differences are positive.
4. To analyze the impact of the course “Methods of chemistry teaching on the basis of information and telecommunication technologies” on the self-assessment of own information competence and its imperative nature among the students of the experimental group.

In order to test the effectiveness of the elective course “Methods of chemistry teaching on the basis of information and telecommunication technologies” we determined the levels of the information competence of the experimental group students before and after the conduct of the experimental work.

Figure 3. The results of the levels of the information competence of the future chemistry teachers.

Based on the above data, it is clear that at an early stage of training, students show higher results if they are
trained within the framework of the methodical system we have developed. The results of the experimental work have confirmed our hypothesis on the effectiveness of the developed methodical system for future chemistry teacher's training to use information and telecommunication technologies in the professional activity:

- The tendency for increasing the ITT influence on future chemistry teacher's training has been revealed.
- The structure of the process of future chemistry teacher's training to use the ITT has been grounded, including the elective course “Methods of chemistry teaching on the basis of information and telecommunication technologies” – “Methods of chemistry teaching (on the basis of information and telecommunication technologies), electronic textbooks for the courses “Inorganic chemistry” and “Descriptive chemistry”.
- The effectiveness of the developed methodical system for future chemistry teacher's training to use the ITT in the professional activity has been proved.

4. Conclusion

In conclusion it should be noted that the reformation of the methodical system of professional chemistry training and its entire new level contribute to the further development and the formation of a future teacher's personality. Future teachers have more opportunities to organize and conduct interesting and informative lessons at which students will not be just passive listeners, as it usually happens when using traditional teaching methods, but in the process of interaction with the computer they will be able to independently search for and systematize knowledge and draw conclusions. Faced with a large variety of training chemistry programs, different types of virtual laboratories that allow simulating chemical processes, future chemistry teachers show special dedication both to practical and theoretical aspects of the educational material under study.

One final comment is that the obtained results of the experimental work on the formation of the future chemistry teacher's information competence indicate a high efficiency of the developed system on the use of information and communication technologies in chemistry teacher training, as well as on the adequacy of the chosen forms, methods and tools to the main goals and objectives of chemistry teacher's training.

At this stage of our research we can state that the formation of the future chemistry teacher's information competence of is a complex, multi-level dynamic process occurring by stages in the professional teacher's training to use information and communication technologies in the process of chemistry teaching.

5. References


