THE ROLE OF MODERN EDUCATIONAL TECHNOLOGIES IN HUMANIZING CHEMISTRY EDUCATION OF FUTURE TEACHERS BASED ON NATIONAL TRADITIONS

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Abstract: The key idea of humanizing chemistry education is the integration of the values of humanity and society with the fundamental content of chemical science and its practical application. The humanizing of chemistry and pedagogy education in institutions of higher education is viewed through the humanizing of the content of chemistry education and the use of modern humanities-based teaching technologies. In the research, the humanizing of the content of chemistry education was provided by the introduction of historical and national elements, namely, information about the Kazakh chemists and their contribution to world science. For the formation, via chemistry education, of the basic educational values stipulated by the State Compulsory Standard of Higher Education of the Republic of Kazakhstan (Kazakh patriotism and civic responsibilities, respect, cooperation, openness), modern educational technologies such as project-based learning, game-based learning, interactive learning and flipped classroom (a model of blended learning) were used. Students of three universities attended the experiment. The control and experimental groups consisting of these students were established. To analyze the formation of basic values via chemistry education a questionnaire method and specially developed assessment criteria were used.
The pedagogical experiment showed the effectiveness of the educational technologies used for the formation of Kazakh patriotism, respect, cooperation, and openness. The specifics of the application of modern humanities-based teaching technologies to chemistry education of students obtaining a bachelor's degree in pedagogy were revealed. These specifics conflict with the traditional approach to education.

Keywords: Humanization of education, Higher education, Basic values, Educational technologies, Chemistry education.

1 Introduction

Humanization of education, understood as orienting the learning process "to the development and self-development of an individual, to the priorities of human values, to optimize the interaction between an individual and society" (1), has been a global trend since the end of the 20th century, extending to all levels of education. Provisions on the humanization of education are enshrined in the legislative acts of many countries including Kazakhstan and Russia. The tasks are assigned for forming personalities with an active life position, who responsibly use the knowledge, skills, and competencies acquired with focusing on the learned moral values. In addition, the importance is attached to the development of patriotism, tolerance, and culture of interpersonal relations. Since the harmonious development of any individual is largely determined by the extent to which an education system is able to transfer not only knowledge and skills but also to develop cognitive interests, value relationships, and striving for self-development with respecting individuality, humanization of pedagogical education is particularly important. (2, 3)

At the present stage of the development of society, the social need for non-standard-minded creative personalities has increased more than ever. The need for the creative activity of a specialist with a developed technical thinking, ability to design, evaluate, and rationalize technologies is growing rapidly. In many ways, the solution of these problems depends on the content and teaching technologies of future specialists.

The trends in the development of educational technologies are directly related to the humanization of education, which promotes self-actualization and self-realization of an individual. New educational technologies contribute to the results of significant researches. Thus, the development of cybernetics and computing led to the development of programmed instruction. The results of research on the patterns of development of human thinking led to the development of problem-based learning. The activity approach arose from the research of psychologists and philosophers in the field of human activity.

In UNESCO documents, learning technology is considered as a systematic method of creating, applying and determining the entire process of teaching and learning, taking into account technical and human resources as well as their interaction. The individual forms and methods of active learning, which make the learning process torn apart, are replaced by holistic educational technologies in general and teaching technologies in particular. The technological effectiveness of the learning process is to make the learning process completely manageable.

An educational technology negates the pedagogical impromptu in practical activities and converts it into the path of the preliminary design of the educational process with the subsequent implementation of a project in a group. In contrast to the developments previously used by teachers in classes, an educational technology proposes a project of the educational process that determines the structure and content of a student's activities, that is, the design of educational and cognitive activities leads to a high stability of the success of almost any number of students. An essential feature of educational technologies is the process of goal formation. This is the central problem of educational technologies, in contrast to traditional education. Thanks to the idea that the subject of an educational technology is a project of a certain educational system, it is possible to formulate an important principle for the development of educational technologies and their implementation in practice as the principle of integrity (structural and substantive) of the whole educational process. The principle of integrity is the harmony of all elements of the educational system.

New requirements of society to the level of education and personal development lead to the need to change teaching technologies. Today, technologies are productive if they allow organizing the educational process taking into account the professional orientation of education, as well as a focus on the personality of a student, his or her interests, inclinations and abilities.

The problem of teaching methods is one of the most important problems of didactics. It remains relevant both in theoretical and in practical terms. The educational process itself, the activity of the teacher and students, and, consequently, the result of the education, depend on this problem's solution. The orientation and nature of students' activities, the degree of their autonomy, and the manifestation of their creative abilities largely influence the success of the education. These factors should serve as important criteria for choosing a method.

The main problem is that the education system does not keep pace with the dynamically changing world, since it remains an appendage to other areas of society, adapts to their interests and serves their private, momentary requests. In this situation, there is an urgent need to revise the basic imperatives of educational activities, to determine its most important priorities. This is a requirement of the modern era of global instability, in which the actions of one person can lead to planetary consequences. When ignoring the problems of education, we are thus "promoting" the generation of people who are not capable of critical, creative thinking, and active participation in various forms of social communications. Therefore, we need an education system that provides the opportunity and the right to be far ahead of all situational demands of society and to set the tone, create an atmosphere of the search for all existing and other areas of society that are possible in the future, helping to develop a creative type of personality.

The issue of education is not only and not so much a problem of a teacher and a student but an issue of a sociocultural nature. The essence of this issue is determined by the search for the harmonious cooperation of both teacher and students supported by the relevant value imperatives of the socio-economic, spiritual, and cultural development of society. Therefore, the idea of humanizing education is so important when discussing

the problems of education in modern social and humanities knowledge. Humanization of education is understood as the ability of education, as a social institution, to ensure that a person acquires a conscious independence in the development of space and time of his or her life. It is possible to judge about the predominance of a positive or negative trend in the process of humanizing the education system on the basis of whether the degree of independence of a subject of educational activity increases or decreases. Humanizing the education system is the main condition for the reproduction of social life in all its diversity. At the same time, the general theoretical ideas about the form and content of the educational process are extremely mobile, and the specific historical types of educational programs of a given society were and remain in a state of constant transformation. Therefore, for modern Kazakhstan, the problem of humanization of education is connected with the fact that, taking into account the overall vector of development of world education in the context of globalization of the organization and structure of educational systems, it is necessary to preserve and use its own positive experience in these activities. (4, 5)

The authors share the fears of those representatives of the domestic social and humanities knowledge who claim that the existing education system, and especially higher education, continues, first of all, to train narrow specialists, qualified doers, and functionaries who are in demand by the technologized system of a labor organization. This leads not only to the prevalence of a utilitarian and pragmatic approach to learning, in which knowledge becomes an informational commodity, a product for sale and consumption but also to the students lose their own totality, to the formation of a "one-dimensional man," (6) and to the fragmentation of human existence since, in the modern technocratic world, "already man rarely meets with himself." (7)

While recognizing the objective nature of the widespread use of information and communication technologies nowadays, one should not stop thinking about their ambiguous influence on the culture of thinking. The adaptation of a person to the world of information technologies creates a "mosaic" style of thinking, the weakening of reflective ability occurs, which leads to the fragmentation of consciousness and has a negative impact on the development of an integral personality, and complicates self-identification. This results in weakening the ability of judgment, profaning objective and evidentiary knowledge, promoting the cult of sensual life, increasing social apathy and infantilism, spreading irrational views and superstitions. All this leads to a decrease in the degree of autonomy of a person in choosing their relationship with the outside world, to the gradual loss of their ability to be independent and responsible in understanding and solving the problems of social and personal being.

A genuine personality, according to Ilyenkov (8), is manifested precisely in the ability to do what everyone else can do but best of all, therefore, establishing a new benchmark of work. The formation of a person is impossible when a person does not gain the freedom to reveal his or her creative potential. Here freedom is understood not in a narrow-minded sense (in the sense of striving to do anything) but in the sense of a developed ability to independently find solutions to issues that arise in real life practice, and, therefore, the ability to act every time not only according to already known standards, stereotypes, and algorithms but also to vary the general methods of action as applied to individual and unique situations. (9)

Among the tendencies in humanizing teacher training in the CIS countries and Europe, there is the humanization of content, individualization, differentiation, the professional orientation of the learning process, and the development of students' subjectivity. (2) The orientation of education to the ideas of humanistic pedagogy and psychology, which have many common international features, at the same time, in different countries, takes into account national traditions and features. The State Compulsory Standard of Higher Education of the Republic of Kazakhstan determines Kazakh patriotism and civic responsibilities, respect, cooperation, and openness as the basic values of the content of education. Requirements for the results of training and the levels of training of graduates are determined on the basis of the Dublin descriptors of the first level (bachelor's degree) and are expressed by competencies.

The strategy of humanizing pedagogical education is implemented via the humanization of each academic discipline, including chemistry. (10) The integration of universal human values and fundamental natural science content is essential for humanizing chemistry education both at university and at school. (11) Humanizing the content of chemistry education is connected with the introduction of historical, environmental, literary, art history and other material into the facts, theories, and laws of chemistry. At the same time, the ideas of humanism extend not only to the content but also to the teaching methods, forms, and technologies that future teachers will transfer to their professional activities, thereby ensuring the continuity of values. The modern concept of humanizing chemistry and pedagogical education based on competencies and personal development requires scientific substantiation and confirmation of the effectiveness of teaching technologies that provide the expected results of chemistry education and the basic values of educational content.

Chemistry education of students obtaining bachelor's degree in pedagogy will contribute to the formation of basic educational values (patriotism, civic responsibilities, respect, cooperation, and openness) if the teaching technologies and humanities-based components of the content are adequate for the goals, justified and used.

2 Materials and Methods

The methodological basis of the research is the modern concepts of development and application of new teaching technologies, the modern pedagogical theories of educational modernization, the fundamental principles of professional pedagogy, the theory of competence-based approach in training specialists of the new formation, scientific foundations of innovative technologies in education, and the researches of chemistry teaching methods for higher education. (12-19)

2.1 Justification of the Choice of Teaching Technologies

The concepts of "pedagogical technology", "technology of education", "teaching technology" are widely used in modern pedagogical literature, but there are certain different interpretations and definitions by various scientists. (20-23) The emergence of teaching technologies in the middle of the last century is associated with the transition from the spontaneous realization of the learning process to the scientific substantiation of each stage of functioning and of each element of the pedagogical system in order to obtain a guaranteed and diagnosable result. (16) There are several components in the concept of pedagogical technology: scientific substantiation and development of goals, content, process, and result; description of the algorithm of actions of students and teacher; practical implementation of the learning process by using an arsenal of instrumental and methodical means. (24) The main function of a teaching technology is the formation of a personality in accordance with the needs of society. From this point of view, all teaching technologies correspond to the ideas of humanization. A teaching technology is always based on a didactic process. 16 Teaching technologies used in domain-dependent learning are called educational technologies, with an emphasis on the triune function of education (training, mentoring and development), which seems more logical in the context of humanization.

Today, traditional and innovative educational technologies are used in chemistry and pedagogical education:

- explanatory-illustrative technologies;
- problem-based learning technologies;
- research technologies;
- conversational technologies;

- collective learning technologies;
- information and communication technologies;
- modular technologies;
- full learning technologies;
- technologies developing critical thinking;
- technologies consolidating didactic units;
- integrative technologies;
- adaptive technologies;
- creative technologies.

The combination and integration of technologies also occur. In modern higher education, the most promising, according to modern researchers (25), are educational technologies based on various forms of interactive learning, project activities, and non-standard forms of conducting classes. A teacher chooses an educational technology based on the goals of applying knowledge in real professional situations, the available means (material, organizational, and didactic ones), and the level of proficiency in the experience of technologization of education. (26) Teachers conducting innovative work are guided by the development of autonomy, active mental activity, creative and communication skills of students. The role of a teacher also changes. A teacher ceases to be a person who just transfers knowledge but becomes a consultant, moderator, and tutor.

2.2 Teaching Technologies in Use

The following teaching technologies were used in the research for the formation of basic educational values of the Republic of Kazakhstan via chemistry education:

- project-based learning for the formation of Kazakh patriotism and civic responsibilities;
- game technologies to build respect;
- interactive learning to form collaboration skills;
- flipped classroom (a model of blended learning) to form openness.

Project-based learning, developed by J. Dewey, has always been associated with the ideas of humanistic education. In chemistry education at university, projects traditionally occupy a significant place. (27, 28) In addition, almost all courseworks and final qualification works are carried out in the form of projects. In addition, the role of projects in the extracurricular independent work of students (29), is high, both in supplementing the content of chemistry education and in forming universal and professional competencies. (17) In this research, the goal of the project was to create a brochure (and eventually a website) about Kazakh chemistry researchers, educators and science organizers. The project was collective in nature. Students were united in groups of 3-4 people and during the semester they prepared material about Kazakh chemists, the presentation of materials was carried out in accordance with the themes of the academic discipline. The teacher determined the methods of presenting the result and established the evaluation criteria. A technical group consisting of three people carried out the integration of materials of each student into a common information product.

Game teaching technologies include a wide group of methods and techniques. Games differ by type of activity and nature of the game technique. They improve emotional state, relieve intellectual tension, and create a space for self-realization of students. (30) Business games in which a student played the role of a teacher or the role of a researcher in accordance with a studied theme were used. The method of the first game was that each of two “teachers” had a group of students consisting of 5-10 people and had to explain them a material, for example, “chemical reaction rate”; then “teachers” swapped to control the knowledge of students of the other group. Then the answers of the two groups were compared, the strengths and weaknesses of the teacher’s explanations were found out, and a reflection was carried out. The second game was used in the study of scientific theories when a student was in the position of "researcher" and had to protect a theory from the questions of "opponents."

The interactive learning technology in chemistry education was used to form cooperation skills. (17) Interactive learning assumes the involvement of a student in the educational process as an active subject. This develops interactions between a student and a teacher, between students themselves, and between a student and learning tools. The joint work of students in small groups in the classroom was used. For example, they performed laboratory work in pairs, issued a report together, and defended the results. In addition, the methods of mutual learning were used, for example, one student teaches another how to work correctly with a device for measuring pH. Mutual control techniques and discussions in practical classes were also used.

Flipped classroom technology (a model of blended learning) was used to form openness. This technology is relatively new for higher chemistry education. (31) It provides students with a preliminary acquaintance with the theoretical material at home, which is actively discussed in the classroom. (32, 33) In the classic version, students should watch a video at home; a presentation is brought to their attention, which is then discussed in the classroom. We conducted five lessons based on the flipped classroom model when studying the "Solutions" theme. It should be noted that in the first lesson, only 10% of students watched a presentation at home and prepared questions. Then activity increased but did not reach 100%.

2.3 Experimental Basis

The pedagogical experiment was conducted in the 2017-2018 school year when teaching inorganic chemistry to first-year students of pedagogical specialty “5B011200-Chemistry” of the Abai Kazakh National Pedagogical University (39 students), Korkyt Ata State University of Kyzylorda (28 students), Zhubanov Regional State University of Aktobe (68 students). In total, 135 students and three teachers took part in the experiment. The students of the Abai Kazakh National Pedagogical University and Korkyt Ata State University of Kyzylorda represented an experimental group (67 people in total), and the students of the Zhubanov Regional State University of Aktobe represented a control group.

3 Results and Discussion

When teaching chemistry to the students of pedagogical specialties, for the formation of basic educational values, four educational technologies were used: project-based learning, game-based learning, interactive learning and flipped classroom (a model of blended learning). Based on the experience of using these technologies, we can say that they in many ways complement and improve each other: they help in the development of a student's subjectivity, increase the level of social activity, teach a student new ways to gain knowledge, stimulate creative abilities. A student becomes an active participant in the educational process when learning, or rather, gaining disciplinary (chemistry) knowledge and skills during their own activities.

At the preparatory stage of the experiment, the working programs of the disciplines were agreed upon and methodological support was prepared:

- a project plan for studying the activities of Kazakh chemists;
- materials for business games;
- presentations and questions to discuss for the flipped classroom model;
- the fund of evaluation tools has been updated;
- materials and methods have been developed to determine the success of the formation of basic educational values in teaching chemistry.

The questionnaire for determining the formation of basic education values when following the course of chemistry included four basic questions several answers, the first question assumes an open answer.

1. Name the Kazakh chemists (scientists, organizers of science and chemical industry, teachers who have contributed to the

chemistry education). The evaluation was made according to a scale: “less than three Kazakh chemists”; “between three and five Kazakh chemists”; or “more than five Kazakh chemists” are named.
2. Do you consider the profession of a chemistry teacher respected? Answer options: “Yes, a chemistry teacher is a respected profession”; "Not sure", "no, a chemistry teacher is not a respected profession."
3. Is the student-teacher collaboration useful in achieving learning goals? Answer options: “No, it's better to do everything individually”; “It is useful to collaborate with other students, but not with the teacher”; “It is useful to cooperate with the teacher, but not with the students”; “Cooperation with other students and the teacher is helpful.”
4. Can you openly express your opinion or attitude if it does not coincide with others? Answer options: “Yes, always”; "Sometimes, depending on the situation"; "I can never."

Answer options were used for interview and monitoring topics.

Table 1. Criteria Adopted for a Generalized Analysis

Parameters	Criteria
Knowledge about Kazakh chemists	The student named more than five Kazakh chemists.
Respect for the teacher	The answer chosen is “yes, chemistry teacher is a respected profession.”
Willingness to cooperate	The answers chosen are “It is useful to collaborate with other students, but not with the teacher”; “It is useful to cooperate with the teacher, but not with the students”; “Cooperation with other students and the teacher is helpful.”
Openness	The answers chosen are “Yes, always”; "Sometimes, depending on the situation."

In the practical implementation of a pedagogical experiment, an ascertaining experiment was conducted, which, according to the results of the survey (Figure 1), showed the similarity of the studied groups of students of pedagogical specialties from three universities of Kazakhstan.

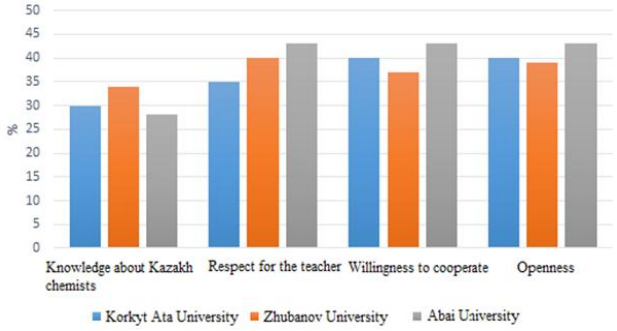

Figure 1. Results of the Survey of the Students at the Ascertaining Stage of the Pedagogical Experiment

The Wilcoxon-Mann-Whitney criterion was chosen as the statistical criterion. The critical value for the studied samples is 1.96. Statistical processing confirmed the “no difference” hypothesis (null hypothesis). The characteristics of the experimental and control groups coincide with a significance level of 0.05. Processing was carried out for all questions of the questionnaire.

The ascertaining experiment showed that students do not know domestic chemists well, and in person, they find it difficult to describe their contribution to the development of science. It is therefore difficult to speak of patriotism. It was surprising to obtain a low percentage of students who believe that the profession of a chemistry teacher is not very respected in society since they themselves chose a pedagogical specialty. Less than half of the respondents showed a willingness to cooperate and openness.

At the formative stage of the experiment, chemistry classes of the first year students of the experimental group were conducted with the use of such technologies as project-based learning, game-based learning, interactive learning and flipped classroom model of blended learning. The classes of the students of the control group were conducted with the use of traditional teaching technologies. Students were observed, interviews with students and teachers were conducted.

At the monitoring stage, a survey was conducted again and the processing of its results (Figures 2 and 3) showed that the students of the experimental group know much more Kazakh chemists and can describe their contribution to the development of science. The respect for the profession of a chemistry teacher was improved. The students appreciate the cooperation with other students and teachers. They have become more open. In the control group, the indicators before and after the start of the experiment changed slightly.

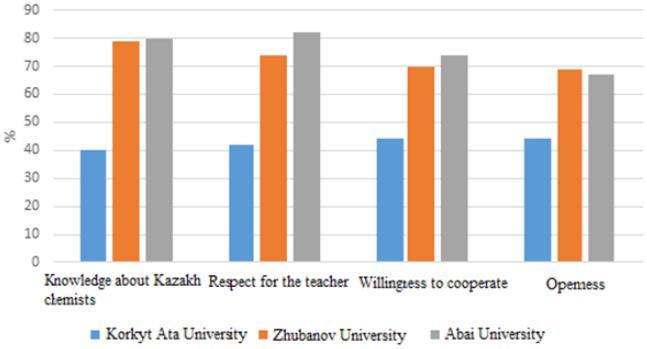

Figure 2. Results of the Survey of the Students at the Monitoring Stage of the Pedagogical Experiment

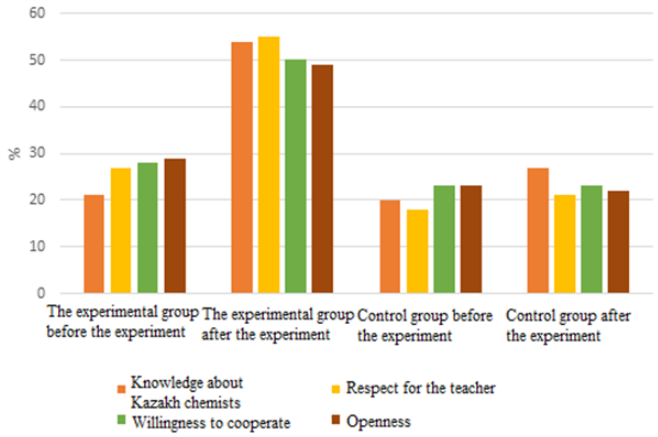

Figure 3. Generalized Results of the Survey of the Students Before and After the Pedagogical Experiment.

The statistical processing showed that the reliability of differences in the characteristics of the experimental and control groups according to the Wilcoxon-Mann-Whitney statistical criterion is 95%. The reliability of the similarity of the results of the control group before and after the experiment coincides with a significance level of 0.05.

Undoubtedly, the most important principle of didactics is the principle of independent creation of knowledge as a result of organized educational activities. Consequently, various types of teaching technologies promote the development of students' cognitive and creative interests. (34)

Thus, various types of humanities-based teaching technologies contribute to the formation of basic educational values in chemistry education. However, the introduction of modern educational technologies does not mean that they will completely replace all the pedagogical experience proven over the years. Any educational technology is a combination of individual techniques, methods, forms and means of training and mentoring, which provides guaranteed planned results. It is very difficult for a teacher to overcome the stereotypes related to conducting classes that have taken shape over the years. Not every teacher is ready to participate in innovation processes, even to the rejection of any innovations, especially since it requires great effort. At the same time, this is a problem for students as they are used to seeing a teacher "on the other side of the desk"; it is difficult for them to accept a teacher as an ally, assistant and mentor interested in their personal success. It is necessary for both of them to understand their own position in a new way, to understand why changes are necessary, and, above all, to change themselves.

This research was conducted at the Department of Chemistry of the Abai Kazakh National Pedagogical University in Almaty. The results of the research were discussed at the meetings of the department, at the international scientific and practical conferences such as "Modernization of natural science education in terms of updated content" (held in Almaty in 2017) and "Modern achievements of the natural sciences, current learning problems: status, new technologies, and prospects" (held in Almaty in 2017) etc. The summarized results of the research are published for the first time.

4 Conclusion

As part of the study, it is shown that it is possible in principle to use modern humanities-based teaching technologies in chemistry education to form the basic educational values in accordance with the requirements of the State Compulsory Standard of Higher Education of the Republic of Kazakhstan. The following four teaching technologies introduced into the educational process (project-based learning, game-based learning, interactive learning and the flipped classroom model of blended learning) influenced the first-year students of pedagogical specialty:

- Kazakh patriotism expressed in the knowledge about domestic chemists and their contribution to world science;
- respect for the profession of a teacher;
- willingness to cooperate with other students and teachers, openness.

Since these technologies were used all together, the authors have not yet managed to figure out the influence of each of them on a certain personality quality. At the same time, there is a definite correlation between the formation of the basic educational values and disciplinary results in chemistry learning. This issue is also to be studied.

In order to increase the effectiveness of professional education, whatever teaching methods are used, it is important to create such psychological and pedagogical conditions in which a student can take an active personal position and fully express himself (herself) as a subject of educational activity. The didactic principle of personal activity in education and professional self-identification determines the system of requirements for a student's learning activities and a teacher's professional activities in a single learning process. This system includes external and internal factors, needs and motives. The ratio of these characteristics determines the choice of the content of education, specific teaching methods, and the conditions for the organization of the whole process of the formation of an active creative personality.

The quality of education consists of the quality of learning and the quality of mentoring. The quality of learning can be achieved only as a result of ensuring the effectiveness of each stage of learning. That is, the whole process of learning is based on the following scheme: to perceive - to comprehend – to remember - to apply – to check. To achieve a high quality of learning, it is necessary to go consistently through all these steps of the cognitive activity. The use of various forms and methods in the learning process contributes to the quality of learning.

The student's emotional state largely determines his or her mental and physical performance. A high emotional tone of the audience and its involvement in the educational process disclose the reserves of a student's personality. If there is no psychological comfort in class, then other stimuli to educational and cognitive activity are paralyzed. The main value of the relationship between a teacher and students is their cooperation, which involves a joint search, joint analysis of success and miscalculations. In this case, a student becomes an initiative partner.

The main teaching methods that improve the quality of learning are role-playing games, business games, seminars, repeating and summarizing lessons, conferences, debates, dialogues, problem-based learning, independent work, making up abstracts, individual work, creative writings, reports, messages, testing, research work etc. All the listed teaching technologies contribute to solving the problem of learning quality.

Humanizing chemistry pedagogical education in practice relies on the creative use of general pedagogical regularities of the learning process based on national peculiarities and traditions. The active participation of students on par with a teacher in the learning process based on individual interests and peculiarities, permeated with respect to all participants of the educational process, creativity, diligence, and interest not only contributes to the development of professional competence of future education system specialists but also helps them to take responsibility for their own future, personal and professional progress. Acquired qualities actively contribute to the socialization of an individual and meet the modern needs of society.

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Primary Paper Section: A

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