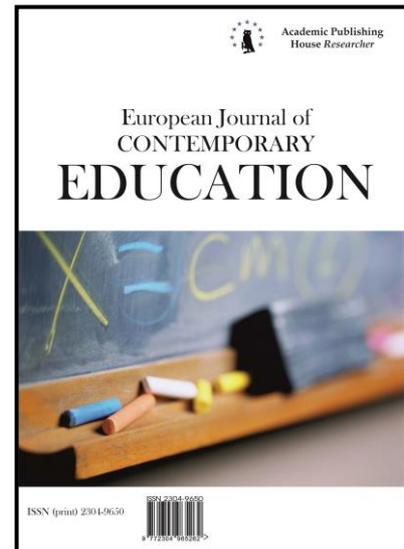




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The Conceptual Approach to the Development of Creative Competencies of Future Teachers in the System of Higher Pedagogical Education in Kazakhstan

Aliya Kh. Sarybayeva ^{a,*}, Meirambek O. Berkinbayev ^a, Bakytzhan A. Kurbanbekov ^a,
Dinara K. Berdi ^a

^a K.A. Yassawi International Kazakh-Turkish University, Turkestan, Kazakhstan

Abstract

The significance of the innovative development of the modern society of the Republic of Kazakhstan (RK) has actualized the need for creative individuals, who determine progress in various spheres of social life. In this regard, the fundamental goal of the modern higher pedagogical school was the development of creative personalities capable of self-actualizing their skills for the benefit of the society. The purpose of the article is the development of conceptual recommendations on the formation and development of creative competence of future teachers as a potential human factor in shaping the value system of the future generation. The criteria for assessing the levels of the formation of creative competence in future teachers in the context of its structural components have been developed. Interviewing helped to analyze the qualitative levels of the formation of creative competence of students of pedagogical universities in Kazakhstan. The article substantiates the main destructive factors of development of students' creativity in the system of higher pedagogical education in modern conditions. The authors developed the structural and logical model for the development of the creativity of future teachers based on the principle of problem education. The authors also developed a diagnostic approach to assessing the effectiveness of the practical implementation of the pedagogical conditions of the creativity model in the educational process of future teachers in higher educational institutions of the Republic of Kazakhstan. The article proves the complex of the actions promoting the evolution of creative competence of students of a pedagogical specialty.

Keywords: creative competence, future teachers, the system of higher pedagogical education, competence approach, creativity, pedagogical conditions, forms and methods of teaching.

* Corresponding author
E-mail addresses: aliya.sarybayeva@yandex.ru (A.Kh. Sarybayeva)

1. Introduction

After the RK signed the Bologna Declaration, the issue of introducing a creative competence approach into the system of higher pedagogical education in 2010 as a new innovative approach to goal-setting in education (Pak et al., 2014). Student creative competence was established as a new target category, which caused the shifts in higher education from the subject-centric orientation of the educational process: transfer of emphasis from content to results, from knowledge to the development of the personality of future teachers (Herppich et al., 2017). In the current conditions of the modern development of the system of higher pedagogical education, the requirements for such qualities of the future teacher have been actualized: how to find non-standard solutions in various situations, openness to learning new experiences, creative attitude to the learning process. The education faced the task of upbringing and training, contributing to the development of the individual, his creativity, adaptation to the ever-changing social environment (Bergsmann et al., 2015). However, in the current conditions of the functioning of the traditional system of training future teachers, the implementation of a competency approach in Kazakhstan is characterized by enhanced substantive training (Rakhmetova et al., 2016). More than 60 % of the student's educational process is devoted to specialized disciplinary training. However, no more than 2 % of the curriculum and hours are spent on psychological and pedagogical training (Uzakbaeva, Zholdasbekova, 2015); moreover, it is carried out outside the context of the vocational training concept. The initial generation of professional experience is minimized: pedagogical practice takes only eight weeks (5 % of study time) from 40 months of study in a higher educational establishment (Uzakbaeva, Zholdasbekova, 2015). This approach creates a threat of a loss of fundamentalism in higher pedagogical education, which involves the cumulative development of the subject and psychological and pedagogical components of it. In such conditions, the quality of the individual and the norms of behavior are adequately formed, corresponding to the creativity and teacher-qualifying profession. In this regard, the purpose of this study was the development of conceptual recommendations that contribute to the formation of pedagogical conditions that ensure the sustainable development of creative competence of future teachers in higher educational establishments of the Republic of Kazakhstan. The research solves the following scientific objectives: assessment and analysis of the level of the formation of creative competence in future teachers in the system of higher pedagogical education of the Republic of Kazakhstan; argumentation of the primary destructive factors of the development of the creativity of pedagogical students; development of a structural and logical model for the development of the creativity of future teachers; substantiation of principal directions of the integrated approach to providing pedagogical conditions for the development of creative competence of students in pedagogical higher educational establishments of the Republic of Kazakhstan.

2. Materials and methods

The methodological basis of the study is interviewing, an expert assessment, and a pedagogical experiment.

The interviewing is an expert method that was used to assess the level of creativity of students – future teachers of physics and consisted of blocks of questions (tasks) that characterize the motivational, cognitive and activity components of creativity. The use of interviewing as a method of research is due to the fact that this method allows for describing the personal attitude of the respondents to the problem in question, quantitatively measure the non-formalized phenomena, which is creativity, for further analysis and development of a model for its development (Shapiro, 2017).

One of the most critical tasks of interviewing is to ensure the sufficiency of a sample set, which is determined by the following formula (Reid, 2015):

$$S = \frac{D(\alpha)^2 \cdot v \cdot (1 - v)}{\varepsilon^2}, \quad (1)$$

where S is the sample's size;

$D(\alpha)$ is the standard deviation determined by the level of confidence (α);

v is the sample's deviation;

ε is the acceptable error level.

Expert assessment was used to theoretically justify the components of creativity and their characteristics. Its results are evaluated by the level of expert competence expressed with the following coefficient (Rousseau et al., 2018):

$$K_i = \frac{\sum_{j=1}^m e_{ij}}{m}, \quad (2)$$

where K_i is the competence coefficient of the i -th expert;

e_{ij} is expert evaluations corresponding to value 0 if the expert considers another one incompetent and does not deem it appropriate to include them in the expert group, and to value 1 if the expert has expressed the need to include another expert in the group;

m is the number of experts.

Levels of motivational, cognitive and pragmatist components of creativity of future students are determined by the results of a интервьюирование (by summing the number of points on blocks) using the Fibonacci rule (Ruiz, Luca, 2017):

$$\begin{cases} e_1 = e_{min} + 0.38(e_{max} - e_{min}) \\ e_2 = e_{min} + 0.62(e_{max} - e_{min}) \end{cases} \quad (3)$$

Where e_{min} is the minimum possible number of points for each block of creativity assessment of students;

e_{max} is the maximum possible score for blocks;

$[e_{min}; e_1]$ is the interval of low values of the creativity index;

$(e_1; e_2]$ is the interval of medium values of the creativity index;

$(e_2; e_{max}]$ is the interval of high values of the creativity index.

In order to assess the effectiveness of the introduction of the proposed model for the formation of students' creativity into the educational process, the pedagogical experiment used the method of purposeful reproduction of the elements of the educational process and its evaluation (Li et al., 2018). This method allows for determining the nature of the impact of the proposed model on the level of creativity of students, quantify the change in the level of motivational, cognitive, and pragmatist component of students' creativity as a result of using the model. The effectiveness evaluation was carried out based on comparing a part of students with high, medium, low creativity in the control and experimental groups. The hypothesis about the effectiveness of the proposed model of creativity formation is confirmed if, according to the results of the experiment, an excess of a part of students with a high and medium level of competence in the experimental group is revealed in comparison with the control group.

The statistical significance of differences between the level of creativity in the control and experimental groups of students is checked with Student's t-test. The empirical value of the criterion, calculated by Equation (4), exceeding the tabulated one indicates statistical significance of the differences; the exceeding tabular value indicates insignificance (Rousseau et al., 2018).

$$t = \frac{M_1 - M_2}{\sqrt{\frac{m_1^2 + m_2^2}{2}}}, \quad (4)$$

where M_1 is the arithmetic mean estimate of the level of creativity in the experimental group;

M_2 is the arithmetic mean estimate of the level of creativity in the control group;

m_1 is the experimental group mean error;

m_2 is the control group mean error.

3. Literature review

From the perspective of the competence approach, the level of education is determined by the ability to solve problems of varying complexity based on the available knowledge and focuses on the ability to use the knowledge gained (Bergsmann et al., 2015).

The concept of "competence" reflects the essential quality of the individual, the general ability and readiness of her to activities based on knowledge and experience acquired in the process of education and socialization, focused on independent and successful participation in activities (Herppich et al., 2017). The authors believe that the competence of the future teacher should be considered in a broader sense than the competence of any other professional activity. Based on the

theoretical analysis in the pedagogical literature of the concept of the competence of the future teacher, it is possible to single out the main structure-forming components:

- exclusive and professional competence in the field of the subject to be taught;
- methodical competence in the ways of formation of knowledge and abilities of students;
- socio-psychological competence in the sphere of communication;
- differential psychological competence in motives, abilities, and orientation of the students;
- experimental and research competence is carried out in the study of educational disciplines, assignments of pedagogical practice, and writing diploma theses;
- autopsychological competence of analyzing the advantages and disadvantages of one's activity and personality (Blaskova et al., 2015; Herppich et al., 2017).

The experimental-research competence contains the following components: 1) Professional, large component: a) knowledge of the essence and technology of the primary research methods; b) research skills and abilities; c) the general level of creativity. 2) Professional-pragmatist component: a) a vision of the problem; b) the formulation of questions; c) the hypothesis; d) mastering the skills of setting and conducting experiments; e) ability to structure the material; f) proof and protection of one's ideas. 3) Professional-personal component: a) motivation and cognitive activity; b) independence in the process of cognition, decision-making and evaluation; c) value orientations; d) manifestation of creativity in a problem situation. Research activities (RA) is a practical and useful condition for the development of creative abilities of students. It aims to create conditions for the comprehensive development and realization of the creative and scientific potential of higher educational establishment students. The basis of the research activity of the future teachers of physics is: possession of the logic of the research process, technology of search and creative activity (forecast of results, problem solving plan, choice of appropriate methods, analysis of results); the ability to prepare and conduct an experiment, evaluate the results of own activities, determine the ways and ways of their correction, mastering the technology of design and presentation of research results. Lessons with elements of research activity are of great interest to students, and this in their turn motivates the learning process.

The fundamental meaning of the concept of artistic creativity is the concept of "creativity."

The modern pedagogical literature there is a stable tradition of understanding creativity as personal integral qualities of individuals to form original values, develop approaches to non-standard solutions, go beyond the generally accepted (Hughes et al., 2018). Numerous scientists synonymize "creativity" and "imagination" as sources of inspiration as a result of human mental associations (Mynbaeva, Galimova, 2015; Pavlenko, 2016; Dubrovskaya, 2017). The authors believe that such an approach is debatable since imagination determines the activity for the process. Creativity is a process of creative activity aimed at creating a qualitatively new product (cultural and material values), searching for a non-standard solution to the problem. However, this term does not provide for the mandatory availability of the result of activities (Kalyuzhnaya, 2015; Anikina, 2016). At that, creativity is the process aimed at the result (Eremina, 2014; Mynbaeva, Galimova, 2015). The result of the activity is a necessary and most important component of the creative process. That is, creativity is a result-oriented process with the goal of creating an end product (Eremina, 2014; Shamaeva, 2014; Mynbaeva, Galimova, 2015). Therefore, creativity can be understood as the ability to create, the ability to create creative results, the ability to the original vision of the problem and situation. The lack of creativity, that is, the competency formed at an insufficient level, causes destructive manifestations of the individual's thinking and, as a consequence, leads to a decrease in creativity. In turn, the identification in the personality of such a phenomenon as creativity leads to the development of its creative potential, the appearance of a perspective for the realization of competencies obtained in the process of education.

In general, it should be noted that there are three approaches to the essence of creativity. The first group of authors distinguish the cognitive nature of creativity as the intellectual ability of an individual to form structural links between different ideas (divergent thinking) (T. Simon, C. Spearman, J. Guilford, F. Galton, E. Torrens) (An et al., 2016; Huang et al., 2017; Hass, 2017).

The point of view of the second group of scientists is positioned on the personal basis of creativity on opportunities, personal potential, self-actualization of the individual. They see it as a specific ability of the individual, due to the presence and combination of various personal qualities.

(W. Duff, E. Toulouse, A. Maslow, C. Rogers, V. Antonishin) (Lai et al., 2018; Neubauer, Martskvishvili, 2018).

The third group consists of definitions in which researchers rely on the social nature of creativity, taking into account the influence of environmental factors on the formation, development, and identification of creativity. They consider creativity as the ability to create an original, unusual product that meets the needs of the surrounding reality (F. Barron, D. McKinnon, R. Sternberg) (Rubenstein et al., 2018).

When it comes to analysis of the approaches, available in the scientific literature, to understand the essence of the creativity of the individual, it can be argued that creativity is not knowledge gained or scientific activity, but a specific skill that can be improved through various methods. It is a stable ability to produce innovation without regard to time, age, image, manner, path, technology, preferences, circumstances, and limitations. It should be noted that understanding this phenomenon as a person's ability to create something new and unique. These new formations occur on the basis and with the adoption of the created by others. This ability assumes a long process of purposeful training, education, and development, as a result of which the individual finds the opportunity to generate original ideas. In other words, creativity develops and is acquired throughout the entire educational process, formed due to the influence of the social environment, the individual's value orientations, the requirements imposed on the individual, the organization of the information flow and the target orientation of all activities.

Based on the foregoing, it can be stated that creativity should be viewed from the point of view of system-content analysis as an integrated category: personal ability and result of personality, social neoplasm - the result of purposeful activity of the individual taking into account the influence of the social environment; the result of human's creative inspiration. Creativity is inextricably linked with intellectual, emotional, reflexive, volitional, motivational and activity spheres of personality.

Thus, within the framework of this research, the creative competence of the future teacher implies the essential dynamic ability of the individual to develop creative abilities on a professional basis among those who will be taught and to the constant self-development of personal creative abilities.

4. Results

Within the framework of this study, interviewing was conducted in the universities of the Republic of Kazakhstan by future teachers of physics in order to determine the level of the formation of creative competence of students. The respondents were 350 students of 1-4 years studying at the specialties 5B011000, 5B060400 "Physics" at the Faculty of Natural Science of Akhmet Yassawi International Kazakh-Turkish University, the Physics and Mathematics Faculty of Auezov South Kazakhstan State University, Natural-mathematical faculty of Korkyt Ata Kyzylorda State University.

In order to ensure the representativeness of the interviewing results, the population of the sample, calculated by the formula 1, should not be less than 273 people (with the volume of the general population – the number of students in the specialty 5B011000, 5B060400 "Physics," more than 100 people.). The survey involved students from versatile and pedagogical universities in Turkestan, Shymkent, Kyzylorda.

Exceeding the minimum threshold for the sufficiency of the sample, the professional orientation, the coverage of all courses of study at the undergraduate level, profile and geographical diversification attest to the representativeness of the interviewing results to determine the level of competence of students-future physics teachers in the Republic of Kazakhstan.

The interviewing was conducted through a computer survey.

The creativity of students was diagnosed by its three components: motivational, cognitive and pragmatist. In order to determine the level of creativity of students for each component, development levels are allocated: low, medium, and high.

The method of common assessments is used to determine the components of creativity and the characteristics of their development levels. The composition of the expert group of 10 people included specialists from the Kazakhstan representative office of the International Association of the Triple Spiral, a non-governmental non-profit organization (KROIATS), whose mission is to develop a creative cluster in the RK, to increase innovation activity (Triple Helix, 2018); governing

bodies of the participants of the Autonomous Cluster Fund, whose purpose is to support the innovation activities of its participants and the development of innovative activities in the country (Techgarden, 2018); teachers of psychology and sociology, physics of Yassawi International Kazakh-Turkish University, Auezov South Kazakhstan University, Korkyt Ata Kyzylorda State University based on which the survey was conducted.

The inclusion of experts from KROIATS and the Autonomous Cluster Fund into the expert group made it possible to study the applied aspect of creativity, and teachers – the psychological and social aspect of the creative competence of future teachers of atomic physics. The expert group consisted of international experts involved in the development of creativity in students, as well as academic teaching staff members of universities of the Republic of Kazakhstan with more than 10 years of experience, which indicates a high level of expert competence. Additionally, to confirm the competence of experts, the competence coefficient was calculated (Equation 2), the value of which is at least equal to 0.8 for all experts, with a minimum acceptable level of 0.5.

Participatory expert assessment was carried out remotely (via the Internet) in several steps until a consistency of expert opinions was achieved: complete concordance of 8 out of 10 experts, in the absence of fundamental objections from the other 2 experts.

The high competence of experts in the problem under study and the consistency of their opinions indicate the importance of the evaluation results, which resulted in the formation of 3 components of student creativity (motivational, cognitive, activity) and determined the levels of development of these components (low, medium, high) (Table 1).

Table 1. Qualitative levels of assessment of the creative competence of future teachers concerning its components

Creative component	Development level	Level characteristics
Motivational	Low	Lack of interest and motivation for creative activity; lack of emotional satisfaction with creative work
	Medium	Episodic interest in the creative activity and unstable motivation; changeable emotional satisfaction with creative work
	High	Constant interest and high level of motivation for creative activity; high level of emotional satisfaction with creative work
Cognitive	Low	Low level of knowledge; lack of ability to identify the problem; inability to systematize and process information on the subject area quickly and qualitatively
	Medium	Not always a high level of knowledge; there are problems with the formulation of the problem, the systematization, and processing of information
	High	High level of knowledge; the ability to identify and formulate the problem, identify tasks that are needed to solve it; ability to process information about the problem without problems; high speed in performing tasks
Pragmatist	Low	Student's solution of stereotypical tasks; the ability to use only standard algorithms in solving problems; standard thinking
	Medium	The solution of stereotyped and diagnostic tasks; the ability to generate single ideas about the solutions to the problem
	High	The solution of heuristic tasks; the ability to generate a large number of ideas; multivariance in solving problems; quickness, originality of thinking

The motivational component of creativity was diagnosed by the level of emotional involvement and satisfaction with creative activity, the level of motivation. At a low level of

development of the motivational component, there is no interest and motivation for the creative activity. There is no emotional satisfaction with creative work. At the medium level, there is an indirect interest in the creative activity and inconstant motivation, changeable emotional satisfaction with creative work. At a high level, there is a constant interest and a high level of motivation for the creative activity, a high level of emotional satisfaction.

The cognitive component of creative competence reflects the availability of knowledge that contributes to the generation of ideas, the ability to formulate a problem, generalize and systematize information on this issue by future teachers. The low level of development of the cognitive component corresponds to the absence of systematized knowledge, the lack of ability to identify the problem, the inability to systematize and process information quickly and qualitatively and to determine the ways to solve it. The medium level corresponds to the presence of problems with the level of knowledge, the ability to formulate the problem; high - a high level of knowledge, the ability to quickly and efficiently process information on the subject area, identify the problem, formulate tasks aimed at solving the problem.

The pragmatist component determines the possibility of using creative competence to perform tasks on the chosen subject area and includes the ability to generate ideas, solve non-standard problems, and obtain a result. The low level of development of the activity component implies the standard of thinking, the ability to use standard algorithms for solving stereotyped problems; middle level - the solution of stereotyped and diagnostic problems; high level - the solution of heuristic tasks that require the generation of a large number of ideas, multivariance in solving problems, speed and originality of thinking.

A written survey was used to assess the level of development of the motivational, cognitive, and pragmatist components of the creative competence of future teachers.

The motivational component was assessed on issues relating to the personal attitude of students towards the creative activity:

1. How do you assess the level of your motivation for creative work?
 - a) High motivation;
 - b) Inconsistent motivation;
 - c) No motivation.
2. How do you assess personal interest in creative activity?
 - a) High interest;
 - b) Episodic interest;
 - c) No interest.
3. Do you get emotional satisfaction with creative work?
 - a) Yes;
 - b) Partially;
 - c) No.

Answers a) are estimated at "3" points, b) - at "2" points; c) - at "1" point. The minimum sum of points for the block of questions is 3, and the maximum is 9.

The cognitive component was evaluated on the basis of knowledge of basic concepts and formulas in atomic physics, such as "photon", "wavelength", "pulse", "energy", "Thomson atom model", "nuclear model of Rutherford atom", "parameter", "Rutherford scattering", "impulse diagram", "differential scattering cross section", "Bohr postulates", "Compton effect", "physical quantity operator", "Heisenberg uncertainty principle", "Bohr formula for the energy of a hydrogen-like atom", "The Balmer-Bohr formula for the one-electron atom", "Einstein equation for the external photo effect", "kinetic energy of formula relativistic particles". Each correct answer was estimated at 0.5 points. The minimum number of points to measure students' knowledge is "0," and the maximum is "9".

Students are asked to solve three tasks of different levels of complexity to evaluate the activity component:

Task 1 (stereotypical). Determine the speed β of the particle relative to the core, if the speed of the core is $0.9 \cdot 10^8$ m/s, and the speed β of the particle is $1.2 \cdot 10^8$ m/s.

Task 2 (diagnostic). The beam $\forall \alpha$ of particles with a kinetic energy of 1.4 MeV was dispersed when passing through a gold foil three μm thick. Determine the probability that the dispersion angle range will be $70^\circ - 90^\circ$.

Task 3 (heuristic). The binding energy of an electron at rest in an atom is 69.3 keV. What should be the impulse for a photon with a wavelength of 15 pm to snatch an electron from the atom that flew at an angle of 80° to the direction of the flying photon?

Correctly solved tasks with explanations, proof of their point of view and justification of the conclusions were evaluated at "1" points (for the stereotypical task), "3" points (for the diagnostic task), "5" points (for the heuristic task). The minimum score for the tasks is "0", the maximum score is "9" points.

The quantitative expression of levels of development of creativity is determined by the Fibonacci rule (formula 3), proceeding from the minimum and the maximum possible number of points for each block of questions. Quantitative criteria for determining the low level of development of the motivational component (3-5), medium - (6-7), high - (8-9]. According to the calculated values, the high level of the motivational component of creativity is determined if the student's motivation, interest in the creative activity, emotional satisfaction are at the highest level, or when one of these indicators is medium, and the other two are high. At the medium level, or all indicators are at the medium level, or 2 indicators – on medium and 1 – at a high level of development of the motivational component of the creative activity. At a low level, all indicators are at low or low and partly on medium (1 or 2 indicators).

According to the cognitive and pragmatist component, the low level corresponds to scores (0-3), medium (3-6), high (6-9). Low level of knowledge in the students who correctly answered less than 34 % of the answers, the medium – 34-67 %, high – over 67 % of the correct answers. The pragmatist component is at a low level if the correctly solved stereotype task is half diagnostic, on the medium – if the correctly solved stereotyped problem and more than half are diagnostic, at high – if the maximal score is solved stereotype and diagnostic problem and more than half – heuristic.

The results of the assessment of the level of creativity of future teachers of atomic physics in the RK are shown in Figure 1.

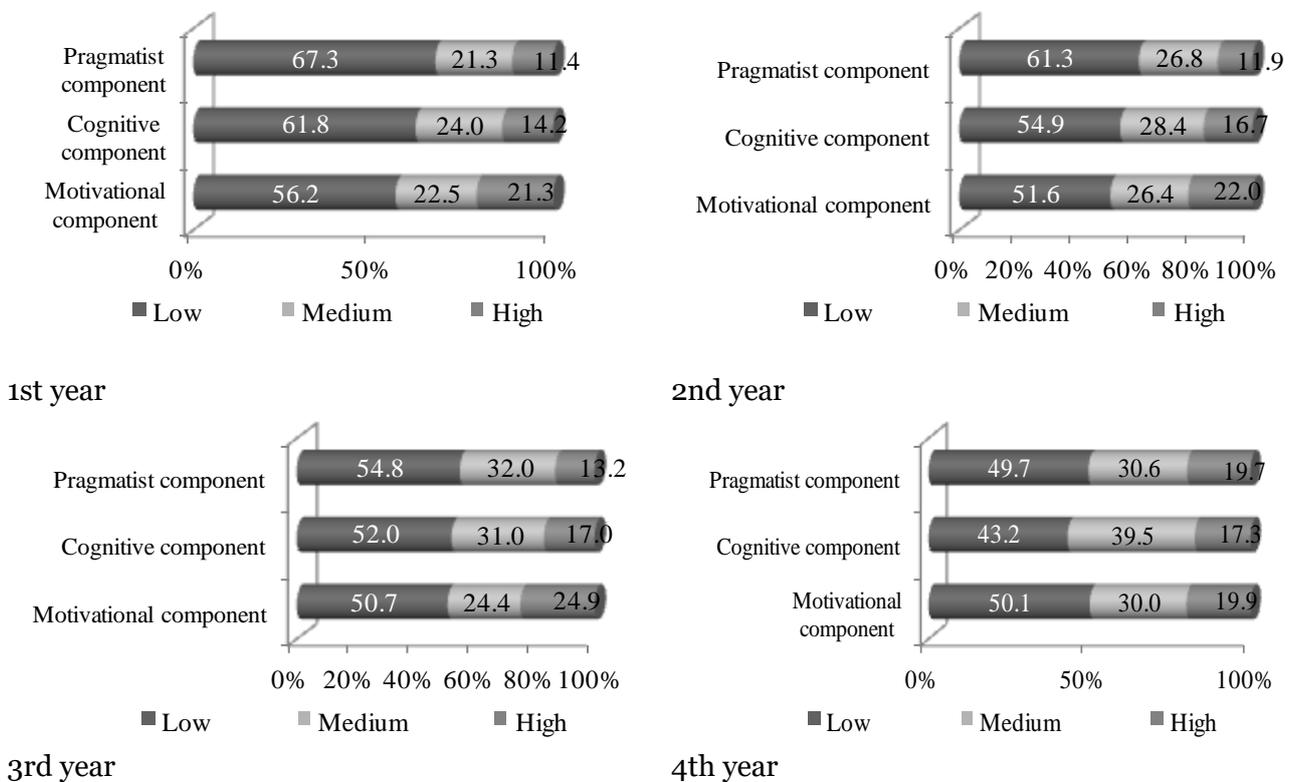


Fig. 1. Assessment of the formation of creative competence of future teachers of atomic physics in higher educational establishments of the Republic of Kazakhstan

According to the interviewing results, the following conclusions can be drawn. The first year students mainly demonstrate a low level of creative competence - the average number was 61.8 %. Only 22.6 % of the total number of students have a medium level of creativity and 15.6% – high. The highest number of future teachers in atomic physics is characterized by the lack of a pragmatist component of creativity – 67.3 %.

The second-year students show 55.9 % with a low level of creative competence; 27.2 % – with the medium; 16.9% – with high. The third-year students show that 52.5 % of future teachers have a low level of creativity; 24.1% – medium and 18.4 % – high. Diagnosis of creativity in the fourth year witnessed a steady trend of decreasing the number of students with a low level of creative competence: 47.7 %. The number of students with the medium level increased to 33.4 %, from high to 18.9 %.

The approaches explain the current situation to education in higher educational establishments. The higher school, when preparing future teachers in the Republic of Kazakhstan, in the process of learning the development of creativity, it is not given sufficient attention either from the point of view of the selected tasks, either from the point of view of their performance or from the point of view of organizing the educational activity. The realization of the competence approach is characterized by the intensified subject preparation of future teachers. This approach creates a threat of a loss of fundamentalism in higher pedagogical education, which involves the cumulative development of the subject and psychological and pedagogical components of it. In such conditions, the quality of the person and the norms of behavior are adequately formed, corresponding to creativity, which meets the requirements of the teacher's profession.

The reason for the formation of a non-creative style of thinking is also the fact that the traditional system of pedagogical education in the Republic of Kazakhstan is primarily the transfer of information from the teacher to the student, which, as a rule, is provided with the necessary answers without formulated questions (Uzakbaeva, Zholdasbekova, 2015). Practical training material, as a rule, has the only correct solution (Kukekeyeva et al., 2014). As a result of such training, a person develops a type of thinking based on previously formed knowledge and operations. While the originality and independence of thinking, the flight of fantasy and ideas, etc. can develop if there is an opportunity to train on tasks and tasks of an "open type," providing for independence in choosing the method of solution. That is, the higher school crystallizes the formal type of training, the result of which is the formation of formal knowledge of future teachers.

The value orientation of future teachers in Kazakhstan's higher school is shaped by the attitude toward "result," which in turn negatively affects the students' quest for research (Rakhmetova et al., 2016). Since modern teachers are encouraging more and more comfortable qualities of students such as conflictlessness, conformity, diligence, etc., but not the real aspiration of the individual to cognition. The current situation threatens creatively gifted individuals, suppressing in them the possibilities of expressing creative potential, in conditions of inadequate evaluation of their successes.

The problem is that the experience of the traditional system of education in higher education (to adapt to the existing structure, rather than create something new) is subsequently projected and produced by future teachers in their professional activities. Evidence of the negative consequences of poor-quality teacher training in Kazakhstan can be evidenced by data on pupils' progress in schools and the level of innovative activity in the country. Upon completion of the primary school, according to official data, more than 80 % of students have a qualitative level of academic achievement "excellent" and "good" (Information and Analytical..., 2018). In the future, their specific weight decreases every year, and at the end of the school their number is less than 10 %, and at the completion of a higher education institution – 0.1 % (Information and Analytical..., 2018). Not the development of creative competence in the system of higher and secondary education forms the risk of reducing the potential of innovative activity in the country as a factor of economic progress. Even though Kazakhstan has improved its position in the world rating on creativity for the last six years by 16 points, nevertheless, out of 126 countries the world, the republic took only 100 places in 2018 (The Global Innovation..., 2018).

Two components provide creation of creativity in students. Subjective component is conditioned by the personal qualities of students (independence, determination, self-confidence, risk appetite, level of development of the imagination). Objective component is the pedagogical conditions in which the creativity of students is formed.

It is advisable to use "active" forms of training to achieve maximum effect in the formation of students' creativity: problem lecture, business game, project method on all types of classroom and after-class work: lecture, practical, laboratory classes and in the independent work of students (Btemirova, 2016; Lovcheva, 2016; Molodtsova et al., 2017).

The problematic lectures provide for the presentation of material that includes the most pressing problems of the discipline under study and requires independent research and development activities of students. Such lectures have a differentiated approach to learning – with the separation of formal groups according to the levels of possible activity and which consists of the stages of the problem posing, its analysis and the participation of students in its solution (Molodtsova et al., 2017).

The business game is used in practical and laboratory classes to consolidate the knowledge gained in lecture classes and independent work. The use of business games develops the ability of students to critical thinking and conducting a well-grounded discussion on a given topic with the necessary arguments in favor of their scientific position (Lovcheva, 2016).

Another form of training that promotes the development of artistic qualities is the method of projects. This method involves solving progressively more complicated practical tasks requiring integrated knowledge, research solutions, the need for independent work (Btemirova, 2016).

When implementing these forms of activating student search and research activities and developing their creative qualities, methods such as Brainstorm, Omega-Mapping, Matrix of Possibilities, etc. were used, which allow for generating many ideas and finding a non-standard, excellent solution to the problem.

Within the framework of the research a structural-logical model "Development of Creative Activity" for future teachers was developed (Figure 2).

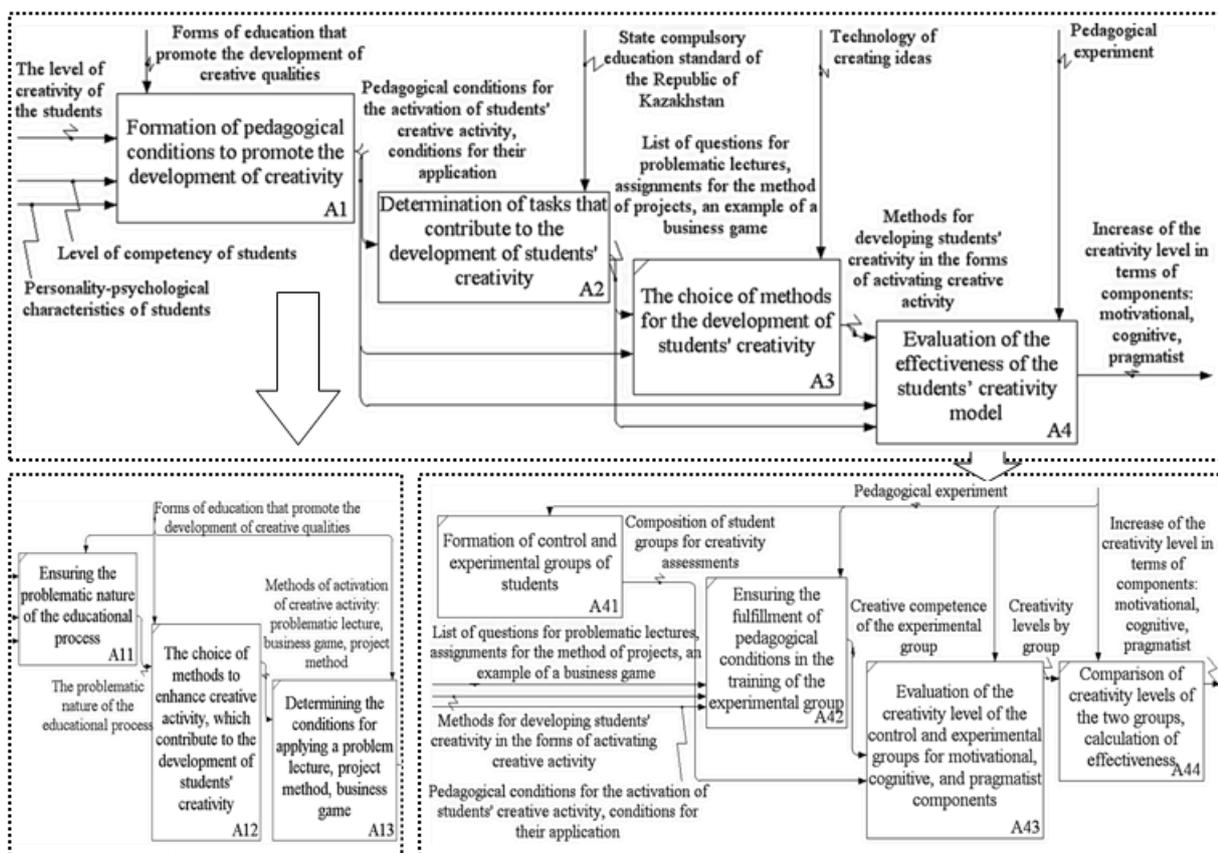


Fig. 2. Structural-logical model "Development of Creative Activity" for future teachers

As an example, a topic from the section of atomic physics "Electronic shell of an atom and Bohr's theory" was chosen as an example for demonstrating the model of creativity formation of students of pedagogical universities in the specialty "Physics."

Creation of students' creativity is proposed to be implemented using the forms mentioned above of activating search and research activities: problem lectures, business games, and project methods.

The following problem questions are raised to develop the creative abilities of students on the chosen topic, requiring the use of non-standard solutions using essential competencies in the field of atomic physics, mechanics, thermodynamics, electrodynamics.

The questions of the problematic lectures:

1. Explain the origin of the main regularities of the emission (absorption) spectrum of ions containing one electron in the electron shell.
2. Find the contradictions of the Bohr's postulates in classical physics.
3. Prove the inconsistency inherent in the Bohr's theory, and the reasons for its occurrence.
4. Determine the possibility of the existence of a static and planetary dynamic model of an atom from classical electrodynamics.
5. Determine the possibility of applying the conclusions of the Bohr's theory for the hydrogen atom, ions containing one electron in the electron shell, and also more complex atoms.

An example of a business game used in the study of the electron shell of an atom and the Bohr's theory.

The topic of the business game: "Contradictions of the Bohr's theory." The rules of the business game provide for the formation of 3 groups of students, each given his task. The task of the first group is to evaluate the scientific and practical significance of Bohr's postulates for atomic physics and physics in general. The task of the second group is to find the contradictions between Bohr's theory and the postulates of classical physics, to reveal inconsistencies in Bohr's theory itself. After the heard arguments of the first and the second groups, there is a scientific discussion, according to which the third group summarizes the contribution of Bohr's theory to the development of atomic physics and physics in general.

Organizational arrangements for the formation of groups and the assignment of tasks are allotted 5-10 minutes; for preparation for the performance of groups – 20-25 min. (5 minutes for generating ideas and 15-20 minutes for their justification); on the performance of the first and the second groups – 10 min each; on the rethinking of the arguments of the participants, the search for counterarguments, scientific discussion – 20 minutes; on the performance of the 3rd group – 10 min, for resuming the results of the game by the teacher – 10 min.

Tasks for use in practical classes when implementing the project method:

1. Two hydrogen atoms are in the ground state. What is the minimum speed that must be given to one of them so that as a result of a collision with another atom, one of them emits a photon? What is the energy of the moving atom? The collision is frontal inelastic.
2. What minimum energy should a photon have, so that when an ion falls onto a singly ionized hydrogen atom, the electron disconnects? Moreover, to make the kinetic energy of a detached electron is 2 eV?
3. Explain what kind of Bohr formula is used to determine the energy of a hydrogen-like atom, if the nucleus of an atom is immobile?
4. What are the speed of motion and the energy of the electron in the first orbit of the helium ion at $n=2$?
5. What is the velocity of the electron in the second and the third orbit of the ionized lithium atom?

The use of problematic lectures on this topic will contribute to the consolidation of theoretical knowledge on the structure of the shell of the atom, as well as on the postulates of Bohr. It will ensure the development of creative thinking aimed at solving non-standard tasks by identifying the laws governing the development of scientific theories and expanding the scope of their application, searching for inconsistencies in Bohr's postulates with classical physics. The use of business games will promote the development of communicative competencies, the skills of reasoning their point of view and making a decision; method of projects - the development of integrative and creative competencies in solving problems. Thus, the problematic lecture contributes to the development of the cognitive component of creativity, the method of projects contributes to the development of the pragmatist component, and the business game contributes to the development of motivational and cognitive components.

The most effective is the application of Brainstorming, Omega-Mapping and the Matrix of Possibilities to solve these problems (Al-Samarraie, Hurmuzan, 2018; Steele et al., 2018). These

methods allow, on the one hand, to systematize knowledge on formalized tasks, which are physics tasks, and, on the other hand, to develop creative, critical thinking necessary for performing heuristic tasks in physics.

The method of brainstorming is a method of group generation of ideas. It is applied during the business game when each participant in the discussion for 5 minutes expresses (writes down) as much as possible of variants of the decision of a task in view. After the ideas are generated, they are processed: they get scientific reasoning using examples that support this or that point of view. The method of brainstorming is applied at the stages of preparation for the performance and search for counterarguments.

The application of the omega-mapping method allows us to find non-standard solutions for the given initial conditions and the final result. This method is most suitable for implementing such a form of activating student search and research activities and developing their creative qualities, as a method of projects, when the condition of the problem (initial conditions) exists and the goal set is to find the unknown (final result). The application of the omega-mapping method involves the implementation of 2 stages: fixing the initial conditions of the problem and the choice of the main idea, which will lead to the final result. It is possible to use an omega-card, which consists of 2 poles (the initial condition and the final result) and branched branches that eventually connect these poles to visualize the solution of the problem. Branches are corresponding to the variants of the solution of the problem, the properties of individual bodies and phenomena described in the problem, formulas, postulates of theories (for example, the properties of an atom, an electron, a photon, Bohr's formula, kinetic energy, etc.).

The matrix of possibilities is used to solve the problems of a problem lecture. It is a matrix in which the properties, principles, laws of the process or phenomenon under study are reflected and by various combinations of elements of this matrix, there is a creative solution of the studied problem.

5. Discussion

Thus, the study revealed that during the education in the higher education system, future teachers are characterized by an increase in the level of the formation of creative competence in the context of traditional education. The number of students with a low level of creativity in the fourth year decreased by 14.1 % compared to 1 course, with the medium level increased by 10.8 %, and with high level – by 3.3 %. Nevertheless, the majority of students have a low level of the formation of creative competence during the four years of studying at a higher educational establishment. At the same time, the most significant number of students in the 1-3 years have a low level of development of the pragmatist component of creativity. The fourth year at a higher educational establishment features the prevalence of future teachers (50.1 %) with a problem with the motivational component. In general, according to the results of the study, more than half of the future teachers of Kazakhstan are characterized by a low level of the formation of creative competence in all its three components.

The developed structural-logical model "Development of Creative Activity" is aimed at the formation of special pedagogical conditions for the development of the creative skills of future teachers. It consists of four blocks forming the educational process of future teachers within the framework of the competence approach. Block A1 consists of the selection of priority "active" forms of students' education, ensuring the development of the need for creativity, creative consciousness and the ability to manage the creative process. Block A2 contains directly the need to develop creative tasks aimed at obtaining variational and non-standard solutions, independence of thinking of future teachers. Such exercises should be the basis for the formation of positive motives for learning and personal self-improvement of the student. Block A3 reflects effective teaching methods in the framework of "active" forms of the educational process: Brainstorming, Omega-mapping, Matrix, and others, providing development of decision-making and systemic thinking skills.

Let us note that the professional activity of the teacher implies a constant analysis of the situations that arise in the educational process. The last block of the model, A4, provides diagnostics of the level of the formation of creative competence among students. Block A4 can be performed out with the periodicity necessary for the definition of the expediency of introduction of the model of increase of creativity. As a diagnostic tool, it can serve as a basis for increasing the practical effectiveness of the entire model in the educational process of future teachers.

The effectiveness of using the methodology for increasing the creativity of future physics teachers was demonstrated through a pedagogical experiment that was conducted on 3rd-year students of the specialty "Physics" at the Faculty of Natural Science of Akhmet Yassawi International Kazakh-Turkish University, the Physics and Mathematics Faculty of Auezov South Kazakhstan State University, Natural-mathematical faculty of Korkyt Ata Kyzylorda State University, in the study course "Physics of atoms and atomic nuclei." The procedure of the pedagogical experiment provided for the formation of 2 samples: experimental (E) and control (C). The control sample studies according to the work program, and the experimental sample studies using the proposed methodology for increasing the level of students' creativity. In order to ensure an initially equal level of creativity and competence in the experimental (E) and control (C) groups, the entire aggregate of students for whom the discipline "Physics of atoms and atomic nuclei" is taught was divided according to the level of academic achievement into 3 groups: with a high level of academic performance, medium and low. Then a random and proportionate selection is made from each group for the experimental and control groups. This approach to the formation of groups ensures the equivalence of 2 samples and the adequacy of the results of the experiment.

Questions to check the level of creativity of students after studying the topic "The electronic shell of the atom and the theory of Bohr" are formed in a similar way as for carrying out interviewing to determine the level of development of the motivational, cognitive, pragmatist component of the creativity of students – future teachers of atomic physics in the RK, but also considering the topic of the lesson.

The results of the evaluation of the creativity of the experimental and control groups are given in [Table 2](#).

Table 2. Results of evaluating the effectiveness of practical implementation of the "Development of Creative Activity" model for the future teachers in the universities of the Republic of Kazakhstan in the educational process

Creative component	Yassawi International Kazakh-Turkish University			Auezov South Kazakhstan State University			Korkyt Ata Kyzylorda State University		
	C	E	Δ, p.p.	C	E	Δ, p.p.	C	E	Δ, p.p.
Part of students with a high level of creativity, %									
Motivational	22.6	26.3	3.7	25.6	30.1	4.5	21.7	24.9	3.2
Cognitive	17.5	21.6	4.1	18.2	22.1	3.9	16.5	20.6	4.1
Pragmatist	13.3	17.2	3.9	14.8	18.3	3.5	11.3	14.9	3.6
Part of students with a medium level of creativity, %									
Motivational	23.8	27.9	4.1	25.1	29.4	4.3	21.2	25.9	4.7
Cognitive	31.1	37.8	6.7	31.5	38.1	6.6	29.6	35.7	6.1
Pragmatist	30.1	35.2	5.1	32.4	37.9	5.5	29.4	37.1	7.7
Part of students with a low level of creativity, %									
Motivational	53.6	45.8	-7.8	49.3	40.5	-8.8	57.1	49.2	-7.9
Cognitive	51.4	40.6	-10.8	50.3	39.8	-10.5	53.9	43.7	-10.2
Pragmatist	56.6	47.6	-9	52.8	43.8	-9	59.3	48	-11.3
C – control group; E – experimental group; Δ is the deviation of the experimental group from the control group, expressed in percentage points									

As a result of testing the development model of creativity of future physics teachers, it is determined that after the introduction of the model, a part of students with a high level of creativity in the studied universities will, on average, increase by 3.8 pp by motivational component, by 4.2 pp – by cognitive and by 4 pp – by the pragmatist.

Some students with a medium level of creativity development will increase by 4.5 pp on the motivational component, 6.5 on the cognitive component, six on the pragmatist component. The percentage of students with a low level of creativity will decrease by 8.3 pp, 10.8 pp, 10 pp. on motivational, cognitive and pragmatist components, respectively.

The statistical significance of differences in the level of creativity in the control and experimental groups was tested using Student's t-test (Equation 4). When the tabular value of the criterion is 1.967 (for the error level $p = 0.05$ and the number of degrees of freedom $df = 348$), the empirical (calculated) value of the criterion was 3.73 for the students of Akhmet Yassawi International Kazakh-Turkish University, 4.01 for the students of Auezov South Kazakhstan State University, 3.93 for the students of Abai Kazakh National Pedagogical University, and 4.62 for the students of Kostanay State Pedagogical University. The calculated values of Student's t-test exceeding the tabulated ones indicate that with the confidence level of 95 % one can assert statistical significance of differences in the levels of creativity in the control and experimental groups of students across all the universities and, therefore, statistical significance of the pedagogical experiment.

As a result of introducing the proposed methodology into the educational process, the percentage of students with a high level of creativity increases, and it decreases in all studied universities for the students with low level of creativity. This indicates the unreliability of the obtained results and does not require additional evidence of the statistical significance of the experiment.

It should be noted that the developed model of the development of creative competence has a universal nature since it can be used to develop creativity in students of various educational specialties. The advantage of the expanded model is the development in the aggregate of all the components of creativity:

- motivational component, including personally significant motives and values; positive attitude to the formation and development of creative abilities and the need for their application in practical activities; self-education and self-development; independence and creative manifestation of personality in professional activities
- cognitive component, including a system of knowledge of the methodology of teaching particular disciplines based on the use of creative technologies;
- pragmatist component that includes research, organizational, design skills that enable the realization of creative technologies for the formation of pedagogical knowledge and skills, to organize independent creative work, to plan educational and creative work;
- personal component, which is a set of pedagogically significant personal qualities of the future teacher: ability to creativity, to solve problem problems; the flexibility and criticality of the mind, intuition, identity and self-confidence; the ability to set and solve non-standard problems, the ability to analyze, synthesize and combine, the ability to transfer experience, predictions, and the like; associativity, imagination, a sense of novelty, sensitivity to contradictions, the ability to empathy; insight, the ability to see a familiar in an unknown; overcoming stereotypes; the propensity to risk and the desire for freedom.

The cumulative development of all components of creative competence is provided by the problematic nature of the proposed development model. The problematical principle combines the learning process with the processes of cognition, research, and creative thinking. Formation of pedagogical conditions based on the problematic education is reduced to the fact that in the learning process the character and structure of cognitive activity of students are transformed, which determine the development of the curative competence of future teachers. The developed model is based on the discrepancy between the existing knowledge base of students and new requirements. Future teachers face with new practical conditions for using the generated knowledge in order to find non-standard ways to use them in practice or to resolve contradictions between the theoretically possible way of solving the problem and the practical impossibility or inexpediency of the chosen method.

Along with the introduction of the proposed model of creativity in the educational process of future teachers, it is advisable to implement the following activities.

The qualification of teachers is a decisive factor for the success of the development of creative competence of students of any specialty in the higher education system. It is necessary to conduct an expert evaluation of the teacher as an organizer of educational activities. The expert evaluation

should be carried out both in the form of introspection, and in the form of evaluation by other teachers, and in the form of an assessment of the primary consumers of educational services-students. It is the lack of necessary knowledge and skills of pedagogical personnel that is one of the main reasons for the low level of creativity of the majority of students in Kazakhstan (Uzakbaeva, Zholdasbekova, 2015).

The following shall be used as the evaluation criteria:

1. Knowledge of educational material: the ability to present educational material; - the ability to find bright, imaginative examples; the ability to show students non-standard opportunities to use the knowledge gained in practice, the ability to establish intersubject communications.

2. Knowledge of the variety of forms and methods used: the ability to transform forms and methods of teaching; the ability to identify in each occupation something new, the possession of active teaching methods; the ability to identify any limiting beliefs or assumptions in an ineffective situation

3. Level of development of creative skills and abilities: the ability to involve students in work; the ability to set and solve creative tasks and produce unique ideas, the ability to create new values and systems independently, invent new ones; the need for self-realization and self-development;

At the level of higher educational establishments, the problem of improving the creativity of pedagogical personnel in the system of higher education in the Republic of Kazakhstan should be solved through special seminars and workshops, reading of specialized literature and the possibility of consulting a specialist. As the analysis witnesses, international practice assumes that if a teacher does not have the necessary preparation for organizing a creative educational process, he/she passes individual courses (Tolegen, 2015). In Kazakhstan, it is advisable to introduce a similar requirement, taking into account the problems of traditional education. In addition to workshops, seminars and training courses for teachers, the activities related to the exchange of experience, in particular, mentoring programs, will be of great benefit.

The active participation of professional non-profit organizations will also contribute to the formation and development of creative competence of future teachers in higher educational establishments of Kazakhstan. These are professional non-profit organizations that have generated a great deal of experience in developing creative skills. Due to the high level of management flexibility, they are carriers of modern and effective methods and can solve the most complex tasks. The development of mechanisms for attracting professional non-profit organizations to the educational environment of the higher education system of the Republic to provide services for pore formation and educational support for future teachers, as well as the training of teachers and staff, will contribute to the outflow of knowledge and stimulate competition in these services. In turn, the introduction of a program of state grants for research and methodological development related to the development of creative competence of students will be a motivational factor to activate professional non-profit organizations.

Along with the proposed activities, the development of the creativity of future teachers will be facilitated by the improvement of the legislative framework, such as adoption of amendments to the Law of the RK "On Education" and the necessary state standard of higher education specifying the psychological and pedagogical preparation of students - future teachers. It is advisable to reorganize the structure of the educational process in higher education, with a reduction in the specific weight of the subject training of future teachers and with an increase in the share of psychological, pedagogical and practical training. This can be guided by the Association for children education international standards. Such an approach will ensure the quantitative and qualitative changes in the field of knowledge, skills, and motives. Quantitative changes are characterized by replenishment of the motives of the chosen profession, increased need for self-development and self-realization, accumulation of general and specialized knowledge. Qualitative changes are characterized by the actualization of motives, knowledge, skills in the teaching process and pedagogical practice.

6. Conclusion

Based on the empirical study, the following conclusions were drawn.

1. In conditions of the prevalence of the subject orientation of pedagogical education in the higher school of the RK, a low level of the formation of creative competence in more than 50 % of future teachers in higher educational establishments of the country is determined. This creates a

threat of loss of fundamentalism of higher pedagogical education, based on the harmonious development of the subject and psychological-pedagogical components of it. The current situation is conditioned by intensified subject preparation of future teachers, the organization of the educational process as a means of transferring information focused on a clearly defined result; lack of pedagogical conditions to ensure the activation of creative thinking of students; deficiency of creative skills of pedagogical staff in higher education.

2. The structural and logical model "Development of Creative Activity" has been developed, the functional purpose of which is the formation of special pedagogical conditions for the development of the creative skills of future teachers. Practical implementation of the model assumes a consistent implementation of the stages in the selection of priority "active" forms of teaching students, the development of creative assignments aimed at obtaining variational and non-standard solutions, the independence of thinking of future teachers, the use of effective teaching methods and diagnosing the level of creative competence among students in the learning process. The educational model has a universal nature and is developed based on the principle of problem learning. Based on the results of the pedagogical experiment in the higher educational establishments of the Republic of Kazakhstan, the introduction of the proposed methodology into the educational process ensures the development in the aggregate of all component components of creativity.

3. The manuscript reasoned the system of measures on development of creative competence of future teachers in the educational process of the higher school of Kazakhstan. These recommendations are aimed at developing the creative skills of teaching staff; on the organization of cooperative cooperation between higher education and professional non-profit organizations; on the reorganization of the structure of the educational process with a decrease in the proportion of subject training. Such an approach will provide for a foundation for the constant development of the creative abilities of future teachers as a factor in the formation of an innovative educational paradigm capable of preparing cadres of creative teachers that play an essential role in the upbringing and education of new generations.

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