



About the competence of teachers in the field of higher education

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Dilfuza Mielievna Makhmudova¹

Chirchik State Pedagogical Institute of Tashkent Region, Amir Temur avenue 104, 111700, Chirchik, Uzbekistan

Siddikov Zayniddin KHoldorovich

Associate Professor, PhD, Fergana branch of Al-Khwarizmi Tashkent University of Information Technologies.

Annotation. The article examines the problem of the competence of teachers in the sphere of higher professional education as one of the important factors in improving the quality of education in the Republic of Uzbekistan. With the solution of this problem, the authors of the article associate their expectations for a high level of training of highly qualified personnel in accordance with the modern requirements of the labor market. A list of reasons is given in favor of the relevance of increasing the competence of university teachers in Uzbekistan. As a subject of research, the authors of this work propose the formation of professional pedagogical competence of teachers in an engineering university in the context of the integration of fundamental and special disciplines using professionally oriented tasks. The article describes the psychological and pedagogical conditions for the formation of professional competence of teachers, as well as the implementation of interactive teaching methods. The authors of the article offer future teachers-teachers a list of basic qualifications that determine the content of their competence and competence.

Keywords: pedagogical competence, interactive method, basic qualifications, vocational-oriented tasks.

DOI Number: 10.14704/nq.2022.20.7.NQ33025

Neuro Quantology 2022; 20(7):211-222

Introduction

Pioneering research by economists in the field of human capital has paved the way for increased attention to the impact of education on the economic prosperity of countries. In the modern world, the quality of education has already become one of the most important factors in the competitiveness of the economy, and therefore, without addressing the qualitative aspects of education, the long-term economic indicators of developing countries, including Uzbekistan, are unlikely to improve. Recently, the focus of research and the emphasis in policy implementation around the world has shifted towards the quality of education as a driver of private incomes and economic prosperity.

While improving the content of professional training of future mathematics teachers on the basis of a competency-based approach, the world pays special attention to expanding the possibilities of problem-based learning, developing

national curricula of a new generation, creating methods of teaching in mathematics based on digital technologies. Especially, the widespread introduction of international assessment programs for the development of mathematical literacy of students (PISA, TIMSS), the improvement of the innovative and professional training of future mathematics teachers, the development of creative competence in the information learning environment are of topical importance.

A number of scientific studies are being carried out around the world to improve the system for the development of the innovative and creative potential of students at the present stage of development of society, the development of interactive technologies for teaching mathematics, and the improvement of the mechanisms for organizing the individual educational trajectory of students in the credit-modular system. Especially, it is important in the development of creative abilities in students, improving pedagogical



mechanisms to ensure the compatibility of theory and practice in teaching mathematics, the use of interactive software. At the same time, there is a need to improve the methodological support of teaching mathematics in accordance with the requirements of international assessment programs, to develop models for the development of students' creative competence based on the expansion of new educational paradigms [1, 2, 3, 6, 8, 9, 10, 11, 12, 13].

In Uzbekistan, the current reforms to raise the content of the higher education system to a qualitatively new level, improve the methods of teaching mathematics, introduce modern information and communication technologies and innovative projects, increase the possibilities for developing the development of a methodological system for training future mathematics teachers, integrating mathematics and general education, implementing advanced teaching methods and technologies. In measures to improve the quality of education in the field of mathematics and the development of research work, it is defined as an important task "Ensuring continuous communication with the production of scientific research in the field of mathematics, the development of applied mathematics and the development of mathematical solutions based on modeling problems in sectors of the economy." And this requires the definition of psychological and pedagogical features and methodological conditions for the development of creative competence of future mathematics teachers, improving the development of a model for the development of creativity and information and methodological support.

Considering international experience (developing countries should develop secondary education to eradicate poverty, and developed countries should develop higher education for economic growth), it is advisable to develop both the general education system and the system of higher education in which the level of return is the highest, since Uzbekistan seeks to get into the group of developed countries. The concept of comprehensive socio-economic development of the Republic of Uzbekistan until 2030 includes issues of increasing the competitiveness of the country's education on the national and international labor markets.

For the successful implementation of the above tasks, Uzbekistan gives priority attention to a comprehensive policy to improve the quality of all three levels of education (primary, secondary and higher). About 6.4% of the annual GDP is allocated to finance large-scale education policy. In this regard, in order to improve the quality of education, the issue of high competence of teachers in the field of higher professional education is relevant, and the result of which, as expected, should be a high level of training of highly qualified personnel in accordance with the modern needs of the labor market. To achieve these goals, since September 2017, the teaching load on the teaching staff has been reduced in favor of conducting research work and increasing pedagogical competence. The importance of increasing the competence of university teachers is also relevant because the curriculum of universities does not always meet modern requirements, however, as well as the quality of training of applicants. Today, new innovative technologies of scientific and technical, mathematical education are being introduced more and more in the world. According to experts from the Ministry of Higher and Secondary Special Education, it is critically important that the lowest results were shown by applicants wishing to master technical specialties, striving to work in a technologically intensive environment, where gaps in school knowledge cannot be filled in by the university program. This is also confirmed by the data of the UNICEF office on the quality of education in Uzbekistan. To train highly qualified specialists in universities, competent applicants are required, who must be trained by highly competent teachers. Another obstacle to the development of professional competence among university teachers is the fact that the sphere of education is quite "conservative" in terms of its reform. In the future, by competencies we will mean a set of interrelated personality traits (knowledge, abilities, skills, methods of activity) necessary for high-quality productive activity, competence will be defined as the possession of competencies. Studying the dynamics of the formation of pedagogical skills among young teachers, we can trace the intellectual development of whether. To train highly qualified specialists in universities, competent applicants are required, who must be trained by highly



competent teachers. Another obstacle to the development of professional competence among university teachers is the fact that the sphere of education is quite “conservative” in terms of its reform. In the future, by competencies we will mean a set of interrelated personality traits (knowledge, abilities, skills, methods of activity) necessary for high-quality productive activity, competence will be defined as the possession of competencies. Studying the dynamics of the formation of pedagogical skills among young teachers, we can follow the intellectual development of the personality, the formation of the abilities and readiness of teachers to apply the knowledge gained, i.e. for the formation of relevant competencies.

Professional competence is an essential characteristic of professionalism, which is an integrative personal quality based on a set of fundamental special scientific knowledge, practical skills and abilities, indicating the teacher's readiness and ability to successfully carry out professional scientific and pedagogical activities.

The object of research is the teaching process at a technical university. The subject of the research is the formation of professional pedagogical competence of teachers in an engineer at a university in the context of the integration of fundamental and special disciplines using professionally oriented tasks.

The aim of the research is to improving the methodology for the development of students' creative competence on the basis of problem learning technologies in the process of teaching mathematics.

The subject of the research is the content, forms, methods and means of developing students' creative competence on the basis of problem learning technology in the process of teaching mathematics.

Literature Review

In Uzbekistan, the theoretical, methodological and methodological foundations for improving the content of education in our country through problematic issues are reflected in the research works of J. Ikramov, T. Tolaganov, NR Gaibullaev, M. Raemov; improving the methods of teaching mathematics, the formation of basic and special competencies in subjects in students are

considered in the works of A.A. Abdukadyrov, S. Alikhonov, B. Abdullaeva, D. Yunusova, M. Tozhiev, N. Muslimov; studies on the development of an independent and creative approach to learning, logical thinking, computer literacy and professional competence are reflected in the research works of M.Sh. Mamatov, U.Sh. Begimkulov, T.Utapov.

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In the countries of the Commonwealth of Independent States (CIS), the issues of methods of teaching mathematics in schools and higher educational institutions, as well as the possibilities of developing creative qualities in the process of teaching mathematics were investigated by V.V. Afanasyeva, V.A. Gusev, A.Yu. Dzhafyarova, Yu. M. Kolyagin, S. I. Osipova, L. V. Shkerina; the concept of a teacher's creative competence, as well as possible ways of its formation and development, was studied by I.Ya. Bryakova, A.M. Davtyan, M.M. Kashapova, L.A. Khalilova; The main content of the formation of creative and creative abilities of students was investigated by D.B. Bogoyavlinskaya, V.V. Davydov, I.S. Konem, A.M. Matyushkin, A.N. Leontiev, A.V. Petrovsky, Yu.A. Ponomarev, S.L. Rubinstein, A.P. Tryapitsyna, A.T. Shumilin.

The scientific research of foreign scientists R. Sternberg, P. Torrance, D. Poy, K. Rogers, J. Hadamard, A. Poincaré, A. Maslow, J. Guildford, J. Renzulli reflects the practical and technological aspects of creative thinking, the development of creative abilities.

Development of a model for the development of creative competence in future mathematics teachers in the context of the widespread introduction of international assessment programs in the education system of our country, substantiation of pedagogical conditions for the development of students' creative competence in the process of teaching mathematics, creation of a set of mathematical problems aimed at developing students' creative competence, the need to develop a diagnostic system determination and assessment of the level of development of students' creative competence in teaching mathematics determined the subject of our research work.

Research Objectives

Based on the analysis on the topic of the problem, the following research objectives have been identified:



- determination of the essence and structure, criteria and level of development of the concept of creative competence of students;
- development of a model for the development of creative competence of future mathematics teachers;
- substantiation of the methodological conditions for the development of creative competence of students in the process of teaching mathematics;
- creation of a complex of mathematical problems that contribute to the development of students' creative competence;
- development of a diagnostic system for determining and assessing the level of development of creative competence of students in the process of teaching mathematics.

Materials and Methods

Research hypothesis: if, in the process of teaching general educational fundamental disciplines, systematically and purposefully ensure its integration with special disciplines at the level of knowledge and at the level of activities, using professionally oriented tasks as the main tool, then this will contribute to the positive dynamics of the formation of professional pedagogical competence of teachers. According to the authors, the formation of a teacher's professional competence can be tracked by the level of mastery of the system of knowledge on the subject being taught, pedagogical skills and abilities, the level of students' perception of the proposed educational material, the ability to interest students in the study of fundamental disciplines: mathematics, physics, computer science, etc. In accordance with the purpose, subject and hypothesis of the research, the article considers the following provisions: description of the psychological and pedagogical foundations of the formation of professional competence of teachers; determination of the role and place of professionally oriented tasks that ensure the formation of professional competence of teachers [25, 26, 27]. The analysis of scientific research and publications on the formation of professional competence over the past few years has shown that there are very few studies devoted directly to the study of the formation of professional competence in future teachers, teachers of higher

educational institutions. At the same time, there are still insufficiently studied aspects related to the identification and implementation of psychological and pedagogical conditions for the formation of professional competence in future teachers and teachers [28, 4, 5, 6]. Thus, the relevance of this study is due to the contradiction between the increased need of society for the training of teachers-educators with professional competence, and the insufficient theoretical and practical development of this aspect of the study. Practice shows that the activation of cooperation between the teacher-teacher and students is possible when implementing interactive teaching methods. Of the existing psychological and pedagogical conditions for the formation of the professional competence of future teachers and educators, we consider important those as the use of interactive teaching methods in the educational process [7, 20, 21, 22, 23, 24].

Research methods

The study used a set of methods to adequately ensure the study of the problem:

- theoretical (analytical-synthetic, comparative-comparative, analogy, modeling),
- diagnostic (polls, tests, observation, projected methods),
- prognostic (expert assessment, generalization of independent assessments),
- pedagogical experiment
- mathematical methods (statistical processing of results, graphical display of results, and others).

In the free encyclopedia, under interactive ("Inter" is mutual, "act" is to action) methods are understood as methods that are "focused on broader interaction of students not only with the teacher, but also with each other." It should be noted that it is the interactive teaching methods, in contrast to the active ones, aimed at changing the nature of the relationship between the participants in the educational process and "aimed at the interaction of participants in such areas as teacher-learner, learner-teacher, learner-learner." In this case, in order to form professional competence, the teacher-teacher needs to solve the problem of developing the activity of students and their initiatives, organizing their dialogical



communication, group cognitive and creative activities. In addition to the above, interactive teaching methods largely reveal the individual capabilities and creative potential of future teachers-teachers, contribute to the successful formation of their professional competence, since they activate their cognitive and pedagogical activities and the successful performance of their professional functions. From the above, we can conclude that the psychological and pedagogical conditions for the formation of the competence of future teachers who ensure professional activity is the ability of teachers to realize their competence in the educational process, and the model of the structure of the professional competence of a teacher-teacher is an example of a system of actions that ensure the unity of his theoretical and practical readiness to the implementation of educational activities. An important indicator of the formation of the professional competence of teachers is their access to the level of creativity in their activities, a deep sense of responsibility and scientific, worldview and value orientations, and therefore the concept of teachers' competence includes pedagogical knowledge and skills, a system of value orientations, habits, etc. the teacher determines the content of competence and competence.

Discussion

Review of foreign scientific research on the topic of the dissertation. Scientific research related to the methodology of developing students' creative competence based on problem learning technologies is carried out in leading research centers and higher educational institutions of the world, including the University of Utara Malaysia (Malaysia), the University of Kent (Great Britain), and the National University of Singapore (Singapore), Hokkaido University (Japan), Bashkir State University (Russia), Belarusian State University (Republic of Belarus), National University of Uzbekistan and Chirchik State Pedagogical Institute of Tashkent region (Uzbekistan).

As a result of research work on the methodology for the development of students' creative competence based on problem learning technologies in the world, a number of scientific results have been obtained, including:

- modern conceptual foundations for the development of creative competence and creative abilities of students have been developed (Universiti Utara Malaysia);
 - improved models for the development of creative competencies, based on a student-centered approach, considering the individual characteristics of students and in teaching mathematics (University of Kent);
 - STEAM educational technologies have been developed to develop the creative competence of future mathematics teachers (The National University of Singapore);
 - an autodidactic system for the development of creative competence of future mathematics teachers was developed (Hokkaido University of Japan); improved methodological mechanism for the development of professional competence of future mathematics teachers (Bashkir State University);
 - a structure for the development of creativity of future mathematics teachers was developed on the basis of the acmeological approach (Belarusian State University);
 - a modernized system of teaching mathematics in an information educational environment was created (National University of Uzbekistan (Uzbekiston Milliy University));
 - an individual trajectory for the development of creativity of future mathematics teachers was determined on the basis of a credit-modular system (Chirchik State Pedagogical Institute of the Tashkent region (Toshkent region Chirchik davlat pedagogy of the institute).
- On the development of students' creative competence on the basis of problem learning technologies, a number of studies are being carried out in the world, in particular, in the following priority areas:
- improving the organizational and methodological base for the development of students' creative competence, considering the practical recommendations of the principles of feedback, systematization, subjectivity and effectiveness of the technological approach;
 - improvement of the didactic system for the application of problem-based learning technologies in the process of higher education



based on the intensive use of adaptive options for information technologies;

- improvement of pedagogical mechanisms for the development of the creative potential of students in the conditions of informatization of education based on considering interactivity;
- determination of the stages of didactic conditions and the level of the algorithm for the development of research competence of students on the basis of problem learning technologies.

The scientific novelty of the research is followings:

- have been determined the essence and structure of the concept of students' creative competence (components, criteria and levels) based on the integrative dynamic nature of personality, which is manifested in their ability to accelerate non-standard levels of thinking to solve certain problems and find solutions using mathematical methods;
- have been improved the methodological stages of the practical application of the model for the development of creative competence in future mathematics teachers based on of ensuring the compatibility of optimal levels of integration with vertical pedagogy with the principles aimed at creating and solving creative problems (normativity, consistency and universality), as well as the requirements set for creative and practical content (inertia, adequacy);
- have been improved interactive learning system for the development of creative abilities of students in teaching mathematics based on research, heuristic, projective, creative tasks for the intensive use of mathematical-didactic (zero-win, antagonistic and matrix antagonistic) games;
- have been developed mathematical problems promoting the development of students' creative abilities, based on considering the horizontal integration of the levels of implementation of problem learning technology with tasks (the smallest circle of the surface of revolution, brachistachron, state coordinates and functionality depending on control) of the mathematics course in the sections "Variational calculation", "Optimal control";
- have been improved methodology for determining the level of development of students' creative competence in the process of teaching

mathematics based on visualization for the use of adaptive options for special methods that provide mobility (problem-solving problems in mathematics, questionnaires, expert sheets aimed at creativity).

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The concept of "competence" can be defined as the social need for educational preparation of a student for the implementation of vocational training, established with regulatory documents (TPA, etc.); competence as a unit of student's personal abilities, based on his experience of performing any activity.

Considering this, on the basis of a comparative analysis of various definitions of the concepts of "creativity" and "creativity" (I.P. Nikitina, Karl Rogers, R. Sternberg, Jiri Kulka, P. Torrens, I.P. Ilyin, N.Yu. etc.), you can express the author's definition of creative competence (CC): it is a set of integrative dynamic qualities of a person, manifested in the ability to define a problem, find a solution based on a new approach, create mathematical problems through non-standard thinking, offer unusual solutions [13, 14, 15, 16, 17, 18, 19].

Within the framework of the study, based on the results of the analysis, the following components of creative competence were identified:

- motivational and personal component - the need for creative activity, awareness of the personal and social significance of creative activity, active manifestation of interest in the creative process and its results, awareness of the need for constant self-improvement;
- cognitive component - creative thinking operations and cognitive methods (analysis and synthesis, comparison, generalization and characterization, concretization, induction and deduction, abstraction, modeling), strategies and algorithms of creative activity;
- activity component - reliance on problem-search methods in the implementation of creative activity, personal readiness to apply strategies and algorithms of creative activity;
- the reflexive-evaluative component - the readiness of the individual to assess his capabilities in order to determine the productive methods of



creative activity and the introduction of amendments to the subsequent actions.

from the point of view of authorship, the structure of creative competence was developed.

- several options for determining the structural foundations of creativity were considered, and
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Table 1. Indicators of criteria for the development of creative competence

Criteria	Indicators
Motivational and personal	<ul style="list-style-type: none"> - the need for knowledge and research; - the accuracy of the intended purpose of the study; - a positive attitude towards creative activity as a personal and professional value; - understanding the importance of the chosen profession; - the desire to engage in creative activities based on a specific goal; - striving for self-development and self-improvement; - willingness to use existing knowledge, skills, competencies and experience in solving professional problems.
Cognitive	<ul style="list-style-type: none"> - have an idea of the specifics of the manifestation of creative processes; - understand the differences in the use of different types of creative activity, depending on the type of activity; - deep and versatile knowledge in the field of creative activity; - the presence of a sufficient number of algorithms that ensure the speed of solving certain creative problems.
Active	<ul style="list-style-type: none"> - demonstration of independence when performing creative tasks; - effective adaptation to new social and professional conditions; - active participation in research work; - mastering various methods of searching and processing information; - intellectual focus; - the ability to creatively apply existing knowledge in practice to achieve high results in professional activity; - apply cognitive skills to acquire and create new knowledge.
Reflexive-evaluative	<ul style="list-style-type: none"> - analysis of the implementation of creative processes, self-control, self-correction and self-expression.

In contrast to the concept of formation, according to the above criteria, the levels of development of creative competence reflect the differentiation and integration of the stages of the implementation of this process.

We consider it expedient to define the boundaries of the level of development of creative competence as follows: reproductive, productive, creative. A detailed description of each level is given in table 2.



Table 2. Levels of assessment of the development of creative competence of students

Criteria	Levels		
	Reproductive	Productive	Creative
Motivational and personal	No need for creativity	The presence of a need for creative activity	The presence of a high need for creative activity
	Designation of the purpose of the activity under the influence of others	The presence of the purpose of the envisaged activity	Accuracy of the purpose of the envisaged activity
	Negative attitude towards creative activity	Positive attitude towards creative activity	Creative attitude to creative activity
	Unawareness of the social and professional value of creativity	Awareness of the social and professional value of creativity	Awareness of a high degree of social and professional value of creativity
	No purposeful creative activity	Purposeful creative activity	High desire for purposeful creative activity
	There is no desire for self-development and self-improvement	The presence of a desire for self-development and self-improvement	The presence of a high desire for self-development and self-improvement
	Low preparation for using the experience of existing knowledge, skills and abilities in solving creative problems	Willingness to use the experience of existing knowledge, skills and abilities in solving creative problems	A high level of readiness to use the experience of existing knowledge, skills and abilities in solving creative problems
Cognitive	Lack of ideas about the specific features of the creativity process	Having ideas about the specific features of the creativity process	Understanding the specific features of the creativity process
	Lack of understanding of the differences in the use of learning activities in different studies related to creative tasks and the type of professional activity.	Understanding the differences in the use of learning activities in different studies related to creative tasks and the type of professional activity.	Deep understanding of the differences in the use of learning activities in different studies related to creative tasks and the type of professional activity.
	Little knowledge in the field of creative activities	Knowledge in the field of creative activity	Deep awareness of creative knowledge
	Based on a ready-made algorithm for solving certain creative problems	Sufficient number of algorithms for solving creative problems	The presence of a personal cognitive strategy, a variety of algorithms for finding solutions to creative problems
Active	Solving creative tasks by example	Independence in solving creative problems	A new approach to solving creative problems
	Low adaptation to creative activities	Indifference to new social and professional conditions	Effective adaptation to new social and professional conditions



Low motivation to participate in research	Indifference to participation in research	Active participation in research
Search and processing of information using conventional methods	Mastering some new methods of searching and processing information	Possession of many methods of searching and processing information
Low intellectual focus	Possession of intellectual orientation	Possession of high intelligence
Reproductive nature of the use of acquired knowledge in practice	The productive nature of the use of acquired knowledge in practice	A creative approach to using the acquired knowledge in practice
Lack of special teaching methods and creation of new knowledge	Ability to apply cognitive skills to acquire and create new knowledge	Ability to creatively apply cognitive skills to acquire and create new knowledge
Reflexive- evaluative		

Thus, based on the analysis of creativity, creative activity, creative thinking processes, components of creative competence, as well as criteria, indicators, levels, the following results were achieved:

1. According to the structure of creative competence, the following tasks of its formation can be distinguished: development of professional education and motivational and personal orientation of students towards the acquired profession; equipping with technologies for organizing creative activities; the formation of reflection and methods of objective self-assessment, skills of emotional and volitional management of creative activity.
2. From a socio-pedagogical point of view, the main task is to form students' creative abilities at a level that ensures effective educational and professional activities and develops the ability to independently acquire knowledge throughout their lives.
3. Clarity has been introduced into the concept of "criteria for assessing the level of development of creative competence" as a qualitative indicator of personality development, which requires a certain period of time and reflects the diversity of creative activity.

4. The expediency of using criteria for assessing the development of students' creative competence as well as components of creative competence: motivational-personal, cognitive, activity-based, reflexive-evaluative has been substantiated.
5. Disclosed the content of indicators of creative competence for each of the established criteria.
6. The levels of development of students' cognitive competence (reproductive, productive, creative) as indicators of creative activity have been determined.

Conclusions

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5. Disclosed the content of indicators of creative competence for each of the established criteria.
6. The levels of development of students' cognitive competence (reproductive, productive, creative) as indicators of creative activity have been determined.

Summarizing the applied research, scientific analyzes, developed proposals and recommendations on the research topic, the following conclusions were made:

1. It was determined that the concept of "creative competence" among students is the sum of integrative dynamic qualities of a personality, which manifests itself in identifying a problem, finding a solution based on a new approach, constructing mathematical problems using non-standard thinking, and the ability to offer unusual solutions.
2. The role of mathematics education at the present stage of development of society, as well as the methodological possibilities of mathematics for the development of creative competence of students are revealed.
3. Based on the results of the analysis, it was determined that for an objective study of

students' creativity, the following components are required: cognitive-creative (creative thinking and imagination), motivational-personal (cognitive, independent and critical), activity (creative activity, perseverance and hard work), correctional appraiser (assessment of readiness for creative activity and making corrections).

4. The expediency of using criteria for assessing the development of students' creative competence has been substantiated, as well as the components of creative competence: motivational-personal, cognitive, activity-based, reflexive-evaluative.
5. The process of developing students' creative competence has become the object of modeling research work, and the subject is the content-methodological system of developing their creative competence.
6. The didactic and organizational-methodological conditions for the development of creative competence of students in the process of teaching mathematics have been determined. Methods and means of teaching aimed at developing students' creativity in classroom and extracurricular activities have been determined.

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