

УДК 378.147:51

## **The Creative Educational Environment of the Mathematics Teacher Subject Training in Higher Education Institution as a Condition of His Professional Competences Development**

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Received 26.07.2013, received in revised form 05.08.2013, accepted 12.08.2013

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*The article proves the necessity of higher pedagogical education implementation in the conditions of creative educational environment. It introduces the notion of the creative educational environment of the mathematics teacher aimed at his professional competences development, studies the pedagogical phenomenon of this notion. It reveals as well the interrelation of the notions “creativity” and “competence” and grounds their inter-cooperation in the corresponding activity implementation. In this relation the educational environment of the teacher’s subject training is regarded as the educational environment which conditions are aimed at creativity manifestation of each student. It offers and substantiates two-dimensional structural – content model of the creative educational environment of the teacher subject training in higher education institution, which in one aspect represents this environment as the complex of the special educational environments, and in the other – the content of each environments by component with their professional directivity characteristics. It gives substantiation that such educational environment modeling approach makes it possible to make the precise designing and support of the pedagogical and technological conditions of the students studying activity implementation aimed at their professional competences development.*

*Keywords: creativity, competence, expert knowledge, educational environment, mathematics teacher, development, two-dimensional model.*

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### **Introduction into research problem**

If one analyses the main positions of the concepts and programs for higher professional education modernization, adopted since the beginning of the XXI century from the view point of its quality as the educational process result, which carrier is a student, one may sum

up that they define the characteristic features of the students training novelty in conditions of globalization, innovativeness and mobility of the world community with “intelligent economies”. Among them there are: fundamental knowledge and their practical usage ability; the ability to put and solve the urgent problems; creativity, etc. The conception of the long-term socio-economic

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development of the Russian Federation for the period up to year 2020 names the involvement of students and teachers in the fundamental and applied research as one of the main conditions of higher professional education development.

The special place in the Russian education modernization belongs to the pedagogical education modernization as a component of the education system of Russia, solving the urgent task of the personnel support of pre-school, general secondary, secondary and higher professional education. The main purpose of the pedagogical education modernization is the mechanism development of the pedagogical education efficient and dynamic functioning in the conditions of the Russian education modernization implementation. The pedagogical education should provide the professionally competent teacher personality formation able to independently and creatively solve the professional tasks.

The national educative initiative “Our new school” (January, 2010) outlined the new requirements for school, its pupils and teachers training quality, which have become urgent in the aspect of the conception of the long-term socio-economic development of the Russian Federation for the period up to year 2020. Speaking at the opening ceremony of the Year of the Teacher in January, 2010 in Saint Petersburg, the RF President underlined that the sense and gist of this project lies in the school formation able to discover the personal potential of the children, to foster in them the interest for studying and knowledge, the aspiration to the spiritual growth and healthy way of life, to prepare the kids for the professional activity with the account of country modernization and innovative development tasks. The national educative initiative “Our new school” – is the strategic policy in sphere of education. It is aimed at the gradual transition to the new education

standards, the teacher potential development and gifted children support system..

The success of the Russian education modernization strategic tasks solution depends on the timeliness of the pedagogical novelties discovery, scientific substantiation and introduction corresponding to these tasks in the area of pedagogical education.

This article purpose is to reveal the specific features of educational environment of the mathematics teacher subject training in higher education institution aimed at his professional competences development, to develop the two-dimensional model of such environment.

The transition from the education paradigm (information transfer) to the teaching paradigm (transfer of competences – potential for action) has become the most important strategic task of education on the way to new quality. This means the adoption of the new paradigm of the education result – the competence approach.

The main education quality update trends and strategies in Russia and other highly developed countries of the world have found their reflection in the Federal State Educational Standards of Higher Professional Education (FSES HPE) where the future specialists training quality, including the teachers, is described in the frames of the general cultural and professional competences.

### **The research conceptual bases**

Nowadays the foreign and Russian authors (J. Raven, V. Gutmacher, Erpenbeck, I.A.Zimnyaya, V.V. Kraevsky, A.V. Khutorskoy, V.Baidenko, V.P. Bospalko, V.A. Slastenin, V.A. Adolf, S.E. Shishov et al.) have in their works outlined the main conceptual points of the competence approach, declared its main idea – to strengthen the practical orientation of the education, to exit the restrictions of “knowledge-abilities – skills” educational environment.

Analysing the various approaches of the Russian and foreign authors to the notions “competence” and “expert knowledge” (V.A. Bolotov, J. Raven, D.I. Izarenkov, V. Medvedev, G.K. Selevko, V.V. Serikov, Yu.G. Tatur, A.V. Khutorskoy et al.), we will define these notions stick to the view point of the authors who as competence understand the integrated formation of personality features, knowledge, abilities, skills, ways of activity in the aggregate with the cognitive, object-practical and personal experience, necessary for qualitative, productive act, related to the certain circle of objects and processes; as expert knowledge there is understood the achievement by an individual of the corresponding competence, including his personal attitude to it and the activity object.

Competence for each student is the image of his future, guideline for mastering, and expert knowledge—the already formed personal qualities for the corresponding competence usage. Thus, in the period of teaching we can develop these or those competences and the corresponding expert knowledge will be the result of this process.

Such teaching result ensuring on the modern stage is connected with a number of problems of both theoretical and methodical nature. These problems consist in the new approaches search to educational environments design and students teaching scientifically based methods development, which will contribute to the professional competences continuous formation and development.

The traditional educational environment of institution of higher education guarantees the mastering by students of the subject knowledge used, as a rule, for tasks solution within one subject limits. Such students – future specialists knowledge is little oriented and has weak professional directivity. These indexes don't meet the main requirements for the students training quality in the framework of competences which

presuppose not only the subject knowledge development, but the ability and readiness to use it for the meta-subjects, professional and practice-oriented tasks solution. All this proves the urgency of the above mentioned problem.

In general it's impossible to create the new, not connected to anything. The new can be new only as compared with the old, the stereotype. Novelty as the creativity analysis criterion can relate to both the creative activity result evaluation and the creativity measurement as the activity kind, as the process.

Creativity (lat. Creatio – creation)— the individual creative abilities, characterized by the generation of the principally new unusual ideas, differing from the traditional schemes of thinking.

Creativity is the ability to generate unusual ideas, to deviate in thinking from the traditional schemes, to quickly settle the problematic situations. The creativity embraces the certain aggregate of the thinking and personal features, necessary for ability to creation development.

A. Maslow states that the real creation, creativity manifests itself in the individual in the everyday real life, everyday life situations choice, in various forms of self-expression. The creativity notion is characterized by the extraordinary wide viewpoints range: it is the creation of the new in situation, when the problem calls for the dominating idea, reflecting the previous experience, it is the going out of the already acquired knowledge limits ; it is the interaction leading to the development (V.N. Druzhinin, K.A. Torshina, F. Baron and D. Harringtonom, J. Gilford).

S. Malevich states that currently there are several hundred definitions of creativity. All these definitions can be divided into several groups. Among them there are: innovative (creativity as the property making it possible to create a new product), expressive (with focus on the creator

self-expression); problematic (describe the creativity as the tasks solution tool). The main difference of creativity from non-creativity, to Gilford opinion, consists in the fact that creative ones look for multitude of answers to one question and all the rest look for the only right answer from all the possible. Each researcher focuses on what he regards as the important, urgent in the context of the problems being solved.

In the creativity research one considers the four main aspects: creative process; creative product; creative personality; creative environment.

Basing on the above mentioned approaches to the creativity notion definition we shall say that the creative personality – is the personality able to see, look for and find the new original solutions of the familiar tasks as well as the sudden, non-typical applications of the available knowledge and experience in new tasks (problems) solution.

As a result of such ability manifestation by the individual we get the new products, including solution methods. Is such new product reception always the creativity? Apparently this product is the result of the individual productive activity form and independence. But will it always bring that new, what will leave the trace in the history of science, music, technology etc. development? In the problem didactic research context, as a rule, this new, original, according to S.L. Rubinstein terms, will be in the history of the creator development, i.e. a student himself. In this connection the creativity manifestation by the students in the educational process will not be the creativity in its general sense.

### **Problem setting**

Results of psychologists research lead us to the didactic conclusion, that formation and development of the students competence from one side is preconditioned by their intellect and creativity, and from the other – contribute to

their intellect and creativity development. At that the first is implemented on the base of students cognitive activity aimed at the acquisition, mastering, application of the already available individual's experience (intellectual activity, actions), and the second on the base of cognitive activity, aimed at the creation of the quite new, for what there are no ready samples available in the personal (social) experience (creative activity). And the educational environment with the corresponding conditions must be available for the possibilities support of the students cognitive activity manifestation aimed at the creation of the new, non-standard. What must the educational environment be?

### **Methodology**

The educational environment has become the research object of many Russian psychologists and pedagogues (S. D. Deryabo, G.A. Kovalev, V.P. Lebedeva, V.A. Orlov, V.I. Panov, V.V. Rubtsov, V.I. Slobodchikov, V.A. Yasvin et al.). Analysing the various approaches to the educational environment point, the researches keep in mind the specific environment of the educational institution, because the educational environment makes up the aggregate of the material factors; space-object factors; social components; interpersonal relations. All these factors are interconnected, they add to each other, enrich each other and affect each educational environment subject, but people as well arrange, make up and execute certain influence on the educational environment.

In the aspect of this article topic we shall base on the approaches offered by V. Ya. Yasvin, who treats the educational environment as the individual development influences and conditions system by the given sample as well as its development opportunities, contained in the social and space-object environment. At that it is underlined that this “given sample” has

always the socially preconditioned character. V.Ya Yasvin singles out the four components in the educational environment structure:

- educational process subjects;
- educational environment social component;
- educational environment space-object component;
- educational environment technological (or psycho-didactic) component.

Educational environment subjects creativity is predetermined by its factors. The educational environment should give the students the corresponding opportunities for creativity manifestation. As creative educational environment we shall understand the educational environment, providing the conditions and affects aggregate giving the students the opportunity for their creativity implementation as personal feature.

The students can manifest their creativity only in the corresponding activity where they get the opportunity to fulfill non-standard tasks, find the alternative solutions, new proof methods, formulate new tasks and solve them, etc. Activity of such kind, from one side requires from students the ability to use their knowledge and skills in the new, unfamiliar situation, and from the other side provides the conditions for understanding and comprehending by the students of the importance and need for such knowledge and skills. These aspects point that such activity is the students' competences development factor. Thus the creative educational environment ensures by its conditions the students activity in which process there professional competences are developing.

Let's address to the creative educational environment phenomenon study aimed at the future teacher of mathematics professional competences formation. In this framework let's address to these characteristic features of the

individual creativity manifestation, which are mostly often stated by researchers. The creativity manifests itself in:

- at the knowledge shortage – in the process of knowledge inclusion into new structures and links; in the missing information identification process in the new solutions search and check process; in the results communication (Torrance E);
- as unexpected productive act done by the executor spontaneously in the certain situation of the social interaction (Johnson);
- non-standard attitude to himself, his labor, socialization, interaction with the other people, to various problematic situation settlement and to the life in general (N.M. Gnatko);
- intellectual creative initiative availability, specific openness to the experience, sensitivity to the new, skill to see and set the problems (A.Ya. Ponomarev);
- ability for problems finding out and setting, to the big number of ideas generating, for non-standard irritants responding, for the object improvement by details adding; ability to solve the problems (R.M. Granovskaya).

The creativity is determined by the environment factors. The creative educational environment should provide the students the opportunities for all their creativity main indicators manifestation. Let's single out the conditions which the educative environment should give to provide the corresponding opportunities.

The bachelor training educational environment specifics will be provided, firstly by its professional directivity which is implemented in the main educational programs, all their cycles mastering process. Each educational cycle has the basic (compulsory) part and variable (profile) set by higher education institution. In the basic,

general professional part of the profile cycle the result is described as well by such features as: to be able to systematically analyse and choose the educational conceptions, to use the psychological and pedagogical diagnostics methods for various professional tasks solution; to take into account in the pedagogical interaction the students various peculiarities, to create the pedagogically purposeful and psychologically safe educational environment, to organize the pupils extra-school activity; to handle the ways of the design and innovative activity in education, etc. The traditional educational process and pedagogical practice due to familiar reasons weakly ensure the opportunities for students for such properties formation and development. Special conditions are required for this, whereby the students can get the corresponding professional activity experience, as any activity skills are formed and develop in this activity process.

In correspondence with educational environment affect continuity and succession on its subject we should organize the students' professional activity elements manifestation from the first year. The academic-cognitive activity of the student – the future teacher of mathematics should contain such two its components as quasi-professional academic activity and professional – pedagogical socialization (L.V. Shkerina, V.A. Adolf, G.S. Savolainen). These activities have goals, object and result specificity and are implemented the teaching professional context or the context teaching. The following principles lie in the base of the context teaching:

- the pedagogic support of the student personal inclusion into the studying activity ;
- integral content, forms and conditions successive modeling of the specialists professional activity in students academic activity;

- students' academic activity organization forms adequacy to the education goals and content;
- the joint activity leading role, interpersonal interaction and dialogical communication of the educational process subjects (teacher and students, students with each other );
- pedagogically substantiated combination of new and traditional pedagogical technologies (A.A. Verbitsky).

These principles determine a certain conditions, influences and possibilities aggregate of the bachelor's professional and personal qualities formation and development as a certain educational environment which we will call the professional educational environment. Let's note that it is purposeful to single out in this educational environment two its types: quasi-professional and professional properly. Quasi-professional is the educational environment in which base lies the students' academic-cognitive activity modeling for teacher's professional activity (professional activity simulation. Professional is the educational environment with the conditions of the actual professional activity (teaching practice, individual and collective work in the educational institution etc.)

Secondly the students training educational environment peculiarity is determined by the standard requirements, reflecting the students ability for research work and namely: ability for generalization, analysis, goal setting and choice of its achievement ways; the ability to apply theoretical and experimental research methods; handling the ways of the design and innovative activity in education. This corresponds to the main trends of the Russian education renovation.

As it has been noted, one of the main conditions of higher professional education development in the modern education model

for period up to the year 2020 is the students and teachers involvement into the fundamental research.

This actualizes the research educational environment organization aimed at formation of the bachelors' search, research activity and their creative skills development.

### Discussion

Taking into account the described creative educational environment peculiarity of teacher training, we shall consider it as the following educational environments system:

- academic environment;
- informational environment;

- social environment;
- additional education environment;
- professional environment;
- research environment.

Let's define the main characteristics of the conditions and opportunities of each educational environment making up the creative educational environment of the future teacher training. The description is given as a Table.

Continuing the creative educational environment structure study of the training of the future teacher of mathematics, let's address to identification of its composition per component as projected to making it up educational environments. Let's identify those main

Table. The educational environments characteristics, making up the creative educational environment of the training of teacher of mathematics

Educational environment type	Conditions	Opportunities
1	2	3
Informational environment	Use of various information sources (libraries, museums, exhibitions, Internet, local information networks, etc.)	Mastering of the main ways and work rules with various information sources ; expeditious exchange of information with domestic and foreign higher education institutions, the enterprises and the organizations; access to modern professional databases, information help and search systems, databases: Russian state library, to an electronic federal portal "Russian education", etc.; acquisition of self-education experience; new knowledge mastering; relation and self-assessment of all these opportunities
Academic environment	Implementation of academic-cognitive activity within the curriculum (studies, independent work, teaching practice)	Common cultural and professional competences formation and development; mathematical disciplines knowledge system development of the curriculum, their methods and abilities to solve interdisciplinary problems; acquisition of mathematical knowledge use experience, skills and abilities in situations settlement of a professional context and experience of professional activity
Social environment	Cooperation with all subjects of educational process (lecturers, students, teachers, pupils) and other people; work in team on performance of urgent tasks, the projects of practical value for the organization of educational process, extra-school life of a class, school or certain pupils.	Formation and development of common cultural and professional competences; acquisition of disciplinary knowledge use experience for the solution of tasks beyond these disciplines (including, professional); works in informal group; communication (interpersonal, pedagogical and professional); reflections and self-assessments of relevance of the knowledge, relations, personal, intellectual and professional statuses (formation); development of internal motive of self-improvement

Continuation table

1	2	3
Additional education environment	Studying on departments and courses of additional education; systematic educational and extra-curricular work according to the interests in subject and inter-subject circles, optional and elective courses, seminars, sections, studios, etc.	Competence upgrade above the main educational program, receiving additional specialty; competitiveness upgrade on a labor market and adaptation in fast-changing conditions of the modern world; knowledge, communication experience widening and upgrade; self-development; self-improvement; self-assertion; educational activity motive development
Professional environment of teacher of mathematics	Continuous transformation of educational activity in professional one by means of the contextual training based on simulating and social training models	Knowledge mastering as of professional tasks solution means, their relevance self-assessment; activity manifestation (educational and social); educational information use experience acquisition as means of activity regulation of the student, transformation of this information from educational subject into professional activity means; development of educational activity motive, professional interest, formation of competences; natural "entry" into a profession without the long difficulties connected with subject and social adaptation.
Research environment	Functioning system of involvement, organization, support and implementation of research activity of students (in mathematical, professional, social, and other areas)	Formation and development of research activity of students (allocation and problem formulation, search and finding of its solutions, the original solution choice; hypotheses formulation and check, carrying out the theoretical analysis and experimental check; research result novelty assessment); development of creative (creation) abilities of students: allocation of new problems, tasks and new ways of the solution, search and implementation of more effective solution; development of the positive relation to innovations and ability to carry out innovative activity.

components which are characteristic to each of the identified educational environment kinds.

Each educational environment has its specific goals. These goals system makes up the creative educational environment goals. Within the competence approach paradigm we assess the educational environment influence result on students as the aggregate of knowledge, abilities, skills and competences which form and develop in the process of the corresponding activities of student. The important factor of the successful activity is acceptance by its subject of this activity goals. Goals as the activity result sample should carry the value systems and guidelines. For a student to actualize the opportunity given to him by the educational environment it is necessary for

goals as values to be accessible to him. In this connection we think it's justified to single out the value-goal component of the creative educational environment of the teachers' subject training.

In the researched educational environment the subjects interaction has the specific features, pre-determined by the specifics of the teacher's subject training. It is implemented as the joint academic, professional (quasi-professional) and research activities, interpersonal, pedagogical and professional-pedagogical communication (L.V. Shkerina). The educational environment educative, developing and up-bringing functions are implemented by means of communication as socialization. The communicative component separation is the most urgent for educational



environment in connection with the need for reflection, evaluation and self-evaluation of the received educational and research result both in subject and the professional area. The extra-curricular communication, communication in the process of research and professional activity, social experience development is of special importance. The separation of creative educational environment social component of the teacher's subject training is becoming purposeful.

Activity component. As it has been mentioned above any competence is mastered by the pupils in the process of the corresponding activity or group of actions performance. As condition for this there is the handling of a certain aggregate of activity methods and ways. As creative educational environment has many aspects, its conditions provide various types of activity performance: academic, informational, self-educational, research, quasi-professional and professional, reflective, evaluative and other. These activity kinds make up certain conditions in each of the singled out educative environments, composing the creative educational environment of the teacher's training.

Organisational – managerial or technological component. The certain processes are brought into reality in the researched which make up the educational process of the teacher training. These processes management is the base of the educational environment functioning. It should be mentioned that in the creative educational environment this management is the object of academic-cognitive activity of students as the subjects of this activity. We sort to this educational environment component: educational standard, main and other educational programs; monitoring system as surveillance, gathering, systematization and information storage system about the education quality; diagnostics, prediction, their results analytical processing and conclusions for managerial decision adoption.

Resource component. It is all the accommodations where any classes or extra-curricular events and sessions are held, libraries, furniture, lighting, heating. All classrooms and their equipment. Electronic educational resources, databases: books, periodicals, testing and assessment materials, lecture texts and other teaching aids.

The creative educational environment is characterized by conditions availability facilitating the opportunities of the creativity main elements development and manifestation by students. Not only research educational environment should provide these opportunities. They should appear in any of the separated educational environments as novelty effect, at least in the form of the new, unexpected use of the already known, new, original tasks solution or the problematic professional situation settlement. Thus in the creative professionally oriented educational environment of the bachelor- future teacher training we single out *the innovative component*.

So, we have singled out seven main creative educational environment components of the future teacher training in the higher educational institution :

- educational process subjects;
- value-goal component;
- communicative component;
- Activity component;
- organizational –managerial;
- resource component;
- innovative component.

### **Conclusion**

This structure is in the natural way projected to all above separated constituents of the creative educational environment: informational, social, academic, professional, research and additional education environment. The above described approach

made us possible to develop the two-dimensional, structural –substantive creative educational environment model of the teacher of mathematics training in higher education institution, which in one aspect represents this environment as the special educational environments aggregate and in the other –substantive per component filling of each environment with their professional directivity characteristics. Such approach to the educational environment modeling makes possible to perform the accurate prediction and support of pedagogical and technological conditions of the students' academic activity – of the future teachers of mathematics, aimed at their professional competences formation.

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## **Креативная образовательная среда предметной подготовки учителя математики в вузе как условие формирования его профессиональных компетенций**

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*В статье доказана необходимость реализации высшего педагогического образования в условиях креативной образовательной среды. Вводится понятие креативной образовательной среды учителя математики, направленной на формирование его профессиональных компетенций, изучен педагогический феномен этого понятия. В том числе выявлена взаимосвязь понятий «креативность» и «компетенция» и обосновано их взаимодействие в реализации соответствующей деятельности. В этой связи образовательная среда предметной подготовки учителя математики рассмотрена как образовательная среда, условия которой направлены на проявление креативности каждого студента. Предложена и обоснована двумерная структурно-содержательная модель креативной образовательной среды подготовки учителя в вузе, которая в одной плоскости представляет эту среду как комплекс специальных образовательных сред, а в другой – содержательное покомпонентное наполнение каждой из этих сред с характеристикой их профессиональной направленности. Дано обоснование, что такой подход к моделированию образовательной среды позволяет производить точное проектирование и обеспечение педагогических и технологических условий реализации учебной деятельности студентов, направленной на формирование их профессиональных компетенций.*

*Ключевые слова: креативность, компетенция, компетентность, образовательная среда, учитель математики, формирование, двумерная модель.*

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