REVISTA ESPACIOS

Forecast of the Development of Education Informatization

Previsión del desarrollo de la informatización educativa

Irena Venyaminovna ROBERT 1; , Iskandar Shamilevich MUKHAMETZYANOV 2; , Anna Aleksandrovna ARINUSHKINA 3; , Vasilina Anatolevna KASTORNOVA 4; , Lora Pasterovna MARTIROSYAN 5

Content

ABSTRACT:

The article substantiates and describes the substantive components of the methodology of the scientific field "Education informatization". The definition of education informatization as a process and a field of pedagogical knowledge has been formulated. The main directions of the development of education informatization have been considered. Methodological approaches to the forecast of the development of scientific and practical zones occurring in traditional sciences and in interdisciplinary research in connection with the development of education informatization and the resulting scientific and pedagogical problems have been presented. The main positions of near-term and long-term forecast of the development of education informatization as a field of scientific knowledge have been described.

Keywords: education informatization; information and communication technologies (ICTs); cognitive-information interaction; convergence of pedagogical science and information and communication technologies; convergence of pedagogical science and high-end technologies; nano-, info-, cognitive technologies; virtual reality technology; a transfer zone; a transfer-integrative field of scientific knowledge.

RESUMEN:

El artículo fundamenta y describe los componentes sustantivos de la metodología del campo científico "educación informatización". Se ha formulado la definición de la informatización educativa como un proceso y un campo de conocimiento pedagógico. Se han considerado las principales orientaciones del desarrollo de la informatización educativa. Se han presentado enfoques metodológicos para el pronóstico del desarrollo de las zonas científicas y prácticas que se producen en las ciencias tradicionales y en la investigación interdisciplinaria en relación con el desarrollo de la informatización educativa y los problemas científicos y pedagógicos resultantes. Se han descrito las principales posiciones de previsión a corto y largo plazo del desarrollo de la informatización educativa como campo de conocimiento científico.

Palabras clave: informatización educativa; tecnologías de la información y la comunicación (TIC); interacción cognitivo-información; convergencia de la ciencia pedagógica y de las tecnologías de la información y la comunicación; convergencia de la ciencia pedagógica y de las tecnologías de gama alta; Nano-, info-, tecnologías cognoscitivas; tecnología de realidad virtual; una zona de transferencia; un campo integrador de transferencia de conocimiento científico.

1. Introduction

In the national scientific development (Beshenkov and Midzaeva 2016; Vagramenko and Yalamov 2015; Kozlov and Kastornova 2012; Mukhametzyanov, 2010; Mukhametzyanov and Dimova 2016; Robert 2014a; Serdyukov and Serdyukova 2014; Tikhonov, Linetsky, Sedova, and Trubochkina, 2014; Tikhonov, Uvaysov, Kofanov, and Sotnikova, 2014, etc.), **education informatization** (Robert and Lavina 2012), a field of pedagogical science, implements the possibilities of the tools of information and communication technologies (ICTs) in education. It is regarded as a task-oriented process of providing the educational sphere with the methodology, theory, technology and practice of developing and optimizing the use of ICT tools in health-saving conditions, which is focused on the implementation of the objectives of education and development of a person, the process that includes the subsystems of education and upbringing.

At the same time, education informatization is currently considered as **a field of pedagogical knowledge** (Robert 2014a), which is oriented towards providing the educational sphere with the methodology, technology and practice of solving the following problems and tasks:

- philosophical-methodological, scientific-pedagogical, socio-psychological, medical, normative-technological and technical prerequisites for the development of education in the context of mass communication and globalization of modern information society;

- a methodological basis for selecting the content of education, developing methods and organizational forms of education, upbringing, which are appropriate to the development of a student's personality and his/her socialization in the modern conditions of the information society of mass communication and globalization;

- methodological substantiation and development of models of innovative technologies and development of existing pedagogical technologies for the use of ICT tools in health-saving conditions in various parts of education (including teaching forms, methods and means);

- prevention of possible risks and negative psychological, pedagogical, socio-cultural and medical consequences when using ICT tools for educational purposes;

- theory of creating methodical education systems aimed at developing the intellectual potential of a student, developing skills to acquire knowledge independently, carrying out activities on the collection, processing, transfer, storage of an information resource, on producing the information;

- theory and technology of developing an electronic educational resource that implements ICT didactic capabilities, software tools and systems of the educational process automation and management, processing of the educational laboratory experiment both practical and virtual one;

- theory and methodology of creating and using the tools of the automation of psychological and pedagogical testing, diagnosing methods of monitoring and assessing the level of knowledge of students, their academic progress, revealing intellectual potential of a student;

- theory and technology of the pedagogical-ergonomic assessment of pedagogical products, functioning on the basis of information and communication technologies;

- improvement of the regulatory and legal framework of the education system in the context of the automation and management of technological processes in education, including on the basis of intellectual information systems.

2. Methodology

In connection with the above-mentioned range of studies, **education informatization is regarded as a transfer-integrative field of scientific knowledge**, since it provides the following: first, this is transfer (from Latin *transfero* – I transfer, displace), i.e. transition

(relocation) of certain scientific ideas or scientific problems into another scientific field, in which a new scientific and practical zone, which has not existed before, emerges (is formed) in connection with it, in accordance with the essential features of this science and the practice of its implementation; secondly, this is an integrative field of scientific knowledge (from Latin *integration* – association), i.e. it brings together certain parts (zones), which originated (were formed) in a particular science, and practices of its implementation in connection with the phenomenon of transfer. Besides, *a transfer zone* is understood as some innovative area of scientific knowledge and its practical implementation, which occurred in certain traditional science due to the need to solve scientific problems introduced to this science as a result of the development of education informatization (Robert 2014a).

Let us consider each of the transfer zones that originated in traditional pedagogical science in the form of certain scientific and practical zones, the essential features of which allow attributing them to pedagogy.

A. *Didactics in the context of education informatization* is considered as a learning theory, the goals of which reflect the requests for the training of a member of modern information society of mass global network communication, the content of which reflects significant changes taking place in science, technology, production, and methods of which are adequate to the modern methods of cognition of scientific, social regularities and implement ICT didactic capabilities (Robert 2014a). The list of components of the transfer zone is provided below:

- improvement of pedagogical theories in the aspect of changing the paradigm of educational and information interaction between a teacher, a student and an interactive source of educational information, functioning on the basis of ICTs;

- improvement of the subject methods that implement ICT didactic capabilities in the context of changing the paradigm of the information interaction between a teacher, a student and an interactive source of educational information;

- creation of methodical education systems oriented to the implementation of ICT didactic capabilities and the use of an interactive information source, including a network source;

- theory of information and objective environment with built-in elements of education technology aimed at changing the paradigm of educational and information interaction between a teacher, a student (trainee) and an interactive source of educational information that implements ICT didactic capabilities.

B. *The theory and practice of preventing possible negative pedagogical effects in the context of the information security of a person* (Robert and Lavina 2012) when a student (trainee) uses ICT resources in educational or leisure activities, involves their consideration in the process of individual, group, and collective activities, as well as in the process of information interaction for educational or leisure purposes in the context of information interaction. The conditions for ensuring hygienic and ergonomic safety of a student in the educational process within the information and educational space of the educational institution and during home schooling activities in health-saving conditions have also been described (Kastornova and Andreev 2015; Mukhametzyanov, 2010; Mukhametzyanov and Dimova 2016).

The scientific-methodical bases of developing the personified information-communication objective environment providing the health forming orientation of a student's activities (psychological-pedagogical and medical-social aspects) have been developed. The psychological and medical-social conditions of the cognitive-information interaction of a user with the tools of information and communication technologies (ICTs) have been revealed. The developed psychological and pedagogical bases of developing and implementing pedagogical innovations in this environment will provide an opportunity to counteract the deteriorating health of students, caused, among other things, by the negative impact of information and

communication technologies on the physical and mental health of students – ICT users (Mukhametzyanov, 2010; Mukhametzyanov and Dimova 2016).

C. Methodology of the development of standards with the use of ICTs in educational and professional activities of teaching staff (Robert and Lavina 2012) involves the creation of standards in the use of ICT tools in professional activities of the following teaching staff members (Kozlov and Kastornova 2012; Polyakov 2016; Robert 2014a): a school teacher, a librarian, a school psychologist, a school doctor; secondary and higher vocational teachers by levels and educational program specialization; the administration of the educational institution by levels and educational program specialization; scientific and scientific-teaching staff in the process of scientific research on various education programs of scientific specialization. In turn, the methodology for developing standards in the use of ICTs by students in educational activities (general secondary education, by levels and educational program specialization, as well as secondary and higher vocational education) implies the creation of standards with the use of ICT tools in the following processes: the acquisition of knowledge on subjects (subject areas); implementation of information activities and information interaction (including the network interaction) for educational purposes.

Thus, through the identification of the directions of integration processes that bring together certain scientific and practical zones, which were formed in certain traditional science and (or) practice of its implementation in connection with the phenomenon of transfer, ***the forecast of the development of scientific and practical zones occurring in traditional sciences in response to emerging issues of education informatization*** can be made, including due to the use of information and communication technologies in the educational sphere. Then, on this basis, ***near-term and long-term forecasts of the development of education informatization as a field of scientific pedagogical knowledge*** can be made.

3. Results

3.1. Near-term forecast of the development of education informatization as a field of scientific knowledge

Let us dwell on ***the main directions of fundamental research in the sphere of education informatization in the aspect of forecasting*** its development for the near future.

In the solution of psychological-pedagogical, medical-social and regulatory problems, philosophical-methodological, socio-pedagogical and medical-psychological conditions for the functioning of the information-educational space of continuous education and the ways of its formation and use are identified and theoretically substantiated. The terminological conceptual apparatus (Robert and Lavina 2012) is introduced and substantiated; it describes the definitions and their interpretation with regard to the information and educational space in terms of the content of the philosophical category "space".

The theoretical and methodological bases of the training of teaching and managerial staff as coordinators of education informatization, intellectual development and socialization of a modern person under conditions of the functioning of the information and educational space are revealed (Robert 2014a). A network model of the methodical system of the training of teaching and managerial staff in the use of information and communication technologies in the professional activity of subject teachers, administration and management of educational institutions, including ICT competences that are differentiated by various positions, is developed (Kozlov and Kastornova 2012).

A scientific and methodological base is developed, which includes pedagogical-ergonomic and medical-psychological requirements for the creation of the high-tech health-saving information and educational environment of the educational institution of various levels and educational

program specialization. Particular importance is given to the development of the theory and technology of scientific and methodological support of the implementation of pedagogical innovations under conditions of its functioning.

A system of psychological, methodical and medical-social support of cognitive-information interaction is developed in the design and implementation of pedagogical innovations in the conditions of the functioning of the high-tech information and educational environment. The models of network interaction between the participants in the educational process in the information and educational environment that implements distance educational technologies are also developed. Theoretical models and educational and methodological support of the person's information security in the conditions of socio-economic, cultural differentiation and global, mass network communication of modern society are substantiated (Mukhametzyanov, 2010; Mukhametzyanov and Dimova 2016).

Each of the above positions will be further described in detail.

3.1.1. Philosophical-methodological, medical-psychological, socio-pedagogical grounds for the creation and development of the information and educational space (Robert 2014a).

Currently, a phrase "educational space" is widely used without a theoretical and methodological background, i.e. without well-founded understanding of its content. In this regard, let us consider the content of the phrase "educational space" in the context of the philosophical category "space" and list its characteristic features in the context of the terminology of pedagogical science.

1) ***Positioning of the element*** (subject, object, process) ***based on the established set of parameters describing a specific element of the space.***

The position of *a subject of the educational space* (for example, *an employee of an educational institution*) involves his/her official status, described by job descriptions with due regard to knowledge and skills in the use of ICT tools in the professional activities. In turn, *a set of parameters* describing the position of a particular element related to the educational space can be considered as *a set of software and hardware tools and systems, scientific-educational and instructional-methodological materials* required for the functioning of technical-technological and information-methodological support of the workplace of an employee of the educational institution.

2) ***The system of parameters describing the position of an element*** (subject, object, process***) of the space.***

A system of parameters describing the position of a subject of the educational space (for example, *an employee of an educational institution*) can be considered as a combination of *software and hardware tools and systems, scientific-educational and instructional-methodological materials.* These positions ensure the functioning of the educational space; they are interrelated, affect the functioning of each of them and have a formal description within the framework of a certain concept of technical-technological and information-methodological support of the workplace of an employee of the educational institution.

3) ***The axiomatics describing the "behavior" of an element*** (subject, object, process) ***of the space.*** The axiomatics describing the "behavior" of *a subject of the educational space (*for example, *an employee of an educational institution*) includes basic provisions (permanently stable), on the basis of which official (or qualification) characteristics of an employee of an educational institution in the sphere of his/her official, scientific, educational, administrative status are formulated. In addition, it includes the conditions and grounds for the *use* of scientific-pedagogical, educational-methodological literature, the program-methodological support that is mandatory for his/her professional activities and determines the legitimacy of his/her official status.

4) ***The possibility of changing the position of an element*** (subject, object, process) ***of the***

space with its subsequent description in the same system of parameters.

Despite the fact that *the professional activity of a subject of the educational space* (for example, *an employee of an educational institution*) is positioned and described with due regard to his/her official status and job duties (qualification characteristics) and the initial scientific-pedagogical, educational-methodological, program-methodological support of his/her professional activities, the "behavior" of the subject can change depending on new objectives and tasks assigned to this employee, in certain "n" directions. There are quite a lot of reasons for this in today's rapidly changing society (innovative training programs, the emergence of new technologies that are actively introduced into education, etc.).

Thus, the concept of "space" in the psychological and pedagogical context is presented upon description (verbal, formalized) of a subject, object, or process by a set of certain parameters that are equivalent upon the concept and can change in "n" directions.

3.1.2. Theoretical and methodological grounds for training of teaching and administrative staff in the sphere of information and communication technologies.

The identification of trends in the development of didactics in the functioning of the information-educational environment implemented through ICTs serves as the basis for ***the development of pedagogical and technological approaches to the creation of a model of the methodical system, which provides the intellectual development and socialization of students in the functioning of the information-educational space.***

The development of scientific-pedagogical support of training of teaching staff in the creation of the information and communication objective environment (Martirosyan 2012; Martirosyan and Safonov 2015), the development of copyright network information resources and the organization of research, management, methodological, cultural and educational activities in the functioning of the information and educational space, is based on the implementation of theoretical provisions of education informatization (Kozlov and Kastornova 2012; Robert 2014a) and scientific-pedagogical and organizational-methodological approaches to the creation of intensive training systems and typical training software/hardware complexes (Kastornova and Andreev 2015; Robert 2014a).

3.1.3. The system of psychological, methodical and medical-social support of a user in the cognitive-information interaction with ICT tools (Mukhametzyanov, 2010; Mukhametzyanov and Dimova 2016).

Ensuring the psychological-pedagogical and medical-social security of the cognitive-information interaction of a user with an interactive source of an educational resource is an important component of fundamental scientific research in the aspect of preventing possible negative consequences of the use of ICT tools in educational activities. Besides, ***the cognitive-information interaction*** will be understood as the information interaction implemented on ICT basis between individuals or between an individual (individuals) and an interactive source of an educational resource (including a network resource), based on personal perception of information (including "concentrated" and information-capacious types of information), an adequately personalized cognitive system created by an individual or with due regard to "personal constructs" (in the terminology of cognitive psychology). The individual's perception of information-capacious information, both verbal and audiovisual, is based primarily on his/her personal features. At the same time, it is advisable to develop skills in the sphere of verbal description of the content of information (information conceptualization); information formalization on the basis of graphs, frames, logical chains, algorithms; information symbolization in the form of pictograms, symbols; graphical interpretation of the content of information in the form of graphs, diagrams; information ontologization on the basis of the introduction of a personalized system of concepts, their subsets and subtypes.

On this basis, it is possible to create requirements for the conditions for implementing the cognitive-information interaction, as well as creating models for its implementation. The

development of mechanisms for diagnosing the motivation for implementing the cognitive-information interaction is of particular importance. Simultaneously, theoretical and methodological approaches to the creation of the scientific and methodological basis for the formation of the competence of the teaching staff in this sphere are developed.

The results of the above-mentioned theoretical developments will serve as the basis for giving medical and psychological recommendations on the use of pedagogical innovations in the context of the cognitive-information interaction of a teacher, a student and an interactive information educational resource.

Scientific and methodological recommendations developed on this basis for the implementation of the cognitive-information interaction of participants in the educational process implemented in the information-educational environment will direct a teacher and students to the safe and comfortable interaction.

The creation and use of software and methodical support of the development and use of Internet resources focused on the socialization of the cognitive-information network interaction between users, as well as the educational-methodological and information support of the formation of a positive focus of the Internet environment by using the tools of networking interaction of schoolchildren, teachers and students, are of applied importance.

3.1.4. Psychological and pedagogical foundations of developing and implementing pedagogical innovations in the high-tech health-saving information-educational environment

Modern education is characterized by its high information richness, combined with modern communication technologies of receiving, processing and presenting the information. Taking into account the developing process of education informatization and the extrapolation of environmental elements on the extra-curricular time, a student, and the educational environment at his/her place of residence, it is more accurate to refer to the formation of the health-saving information-communication educational environment of a student. This is the organizational and methodical environment to a greater extent, which is characterized by certain features associated with the integration of the tools of information and communication technologies into the traditional educational environment. In turn, it changes all the traditional links between the components of the environment and the participants in the educational process. At the same time, this form of symbiosis of the educational environment of the educational institution and modern information and communication technologies changes the existing education environment, originally standardized by applicable regulations. The integration of technical tools and technologies, the impact of which on the user's health is less known or unknown, in the education environment takes place not only due to their prevalence in the educational environment, but also against the delay in the sanitary rules applied to technical education tools. All this often leads to the situation when the educational process takes place under chronic stress, which is caused by the following reasons: high responsibility of students in decision-making; inadequate assessment of the learning situation by a student or his/her parents; non-conformance of learning results with the requirements for the educational institution; violation of the trajectory and the speed of education required by parents, which is conditioned both by the peculiarities of the educational institution and by the student; a change in the natural rhythm of life and the organization of work and rest schedule, based on the recommended average indicators. The quality of the organization of the high-tech health-saving information-educational environment of a student will be determined not so much by the correspondence with the existing grounds within the educational institution, as by the combination of characteristics of this unified environment, related to the ability to meet the established and anticipated educational, information and upbringing needs both of students and the education system as a whole. In addition, information technologies remove the existing limitations on the training of people with special educational needs. This requires the adaptation of the environment both to the indicators of the health of such students (for example, visually and hearing impaired students, etc.), and to the technical learning tools used outside the

educational institution, which turn this environment into a high-tech one.

The foregoing determines the importance of the ***development of methodological, socio-psychological and pedagogical-ergonomic requirements for the functioning of the high-tech health-saving information-educational environment of the educational institution.***

3.1.5. Scientific and methodical support of the information security of a person in modern society.

The conducted analysis for revealing the characteristic features of the influence of the information society, of mass network communication on a person made it possible to reveal the phenomenon of the information society of global mass communication that negatively affects the personality, including in the process of learning when working in the Internet environment – "distributed consciousness". Today, the idea of creating a multiverse model describing the phenomenon of "distributed consciousness" is being developed, on the basis of which a model approach neutralizing the negative impact of this phenomenon on a person has been formulated and substantiated (Beshenkov and Midzaeva 2016).

The prospective concept of information security of a person assumes the consideration of the features of a user of different age categories as a social noo-subject who can perceive and implement future innovations in the conditions of socio-economic, cultural differentiation, mass communication and globalization of modern society. At the same time, the scientific and methodical support of the information security of a person (Polyakov 2016) involves the following: the identification of stable behavioral algorithms, mechanisms, means of information protection of a person in the conditions of global mass network communication of modern society and the development of complex methods of the formation of stable personal states as a social subject, ensuring its information security and the ways of active counteraction to negative influences of the information-aggressive Internet environment.

In this regard, ***a methodical system of staff training is created and a theory and methods of the formation of competencies among students of pedagogical universities in the sphere of information security of a person, whose life activity is implemented in the conditions of modern information and globalization society, are developed.***

3.2. The long-term forecast of the development of education informatization as a field of scientific knowledge

The main directions of the long-term forecast of education informatization have been revealed upon the analysis of technical and technological innovations initiating the development of the information society of mass network communication and globalization, the convergence of sciences and technologies, as well as the intensive development of nano-, information and cognitive technologies (Mukhametzyanov and Dimova 2016; Fundamentals of the Policy of the Russian Federation in the Sphere of the Development of Science and Technology for the Period until 2020 and Further, 2012; The List of Critical Technologies of the Russian Federation (in the Part of Information and Telecommunication Systems), 2011). Their description is provided below.

3.2.1. The development of the learning theory and various approaches to learning (personality-oriented, activity-oriented, competence-based approaches to learning, problem-base learning, learning algorithmization, etc.) is caused by the following factors:

- a change in the paradigm of the educational information interaction (including the implementation of the network paradigm), in which a student, a teacher and an interactive source of educational information become intellectually active in the conditions of the

functioning of the information-educational space;

- the use of electronic databases and banks of educational-methodical materials, including "experimental data banks", "trial and error banks", "libraries of methodological solutions", etc.;

- performance of various types of educational activities by using ICT tools (information activities for the search, collection, processing, use of educational information, as well as activities for stimulation, formalization, production of the educational material, including in electronic form);

- improvement of pedagogical technologies oriented to the performance of independent educational and information activities and socialization of network interaction both with users and an interactive electronic educational resource.

3.2.2. Convergence of the pedagogical science and science-intensive technologies.

Taking into account the meaning of the word "convergence" (from English *convergence* means approximation, merger, assimilation, or from Latin *convergens* means coinciding or *convergere* means to approach, converge), **convergence** is defined as merger, approximation or similarity, the coincidence of some features or properties of independent objects, processes, phenomena. The adjective **convergent** is defined as *characterized by convergence* (Kovalchuk 2011; Robert 2014ab).

The pedagogical science will be considered as a science of a specially organized, purposeful and systematic activity of a teacher aimed at teaching, educating, and transferring social experience to students with the use of certain forms and methods of distribution of the content of education. Modern information and communication technologies (ICTs) are considered in this context as a practical part of the scientific field of informatics, which is a combination of means, procedures, methods of automated collection, processing, storage, transfer, use, production of information in order to obtain certain, obviously expected results. At the same time, an information technology, which is implemented by means of microprocessor, computing ("computer") *equipment*, has the following specific features:

• implementation of capabilities of modern software, hardware and technical facilities and devices, means and systems of transfer and broadcasting of information resources, information exchange;

• use of special formalisms (logical-linguistic models) for representing declarative and procedural knowledge in electronic form; logical-linguistic modeling sharply expands the possibilities of solving problems for difficult or completely unformalized areas of knowledge and spheres of activity;

• provision of a direct (without intermediaries) access to the dialog mode when using professional programming languages and artificial intelligence tools;

• ensuring the simplicity of the process of the user's interaction with the computer, excluding the need for regulatory support.

The implementation of all the above positions is based on specific features of ICTs noted above.

The convergence of pedagogical science and information and communication technologies is defined as an approximation, merger, conformation of pedagogical technologies with ICTs, as well as their mutual influence on each other, the emergence of similarities in the functions of the pedagogical science and ICTs, as well as in the structures of pedagogical technologies and ICTs. The process of the convergence of pedagogical science and technologies initiates the development of education informatization due to the mutual influence of different areas of the psychological-pedagogical science and information, communication and cognitive technologies. At the same time, promising fundamental scientific research is focused on the creation of theoretical and methodological grounds for learning the regularities of development of education informatization based on the identification of the conditions for mutual influence and the penetration of information and communication technologies into

pedagogical technologies and vice versa, as well as for identifying similarities in the functions and structures of information and communication technologies and pedagogical technologies.

On this basis, the creation of information and communication objective environments with built-in elements of the learning technology for each subject (subject area), which allow providing a teacher and a student with a tool of visualization of the objects of this subject area, a tool of measurement and study of regularities for the independent "micro-detection" of the regularity under study, is expected. The consequence of the above is **_the creation of methodological teaching systems in the conditions of the functioning of information and communication objective environments with built-in elements of teaching technologies (for each subject or subject area)_** providing the simulation of various operationalizations that can be described; the creation of virtual models simulating the dynamics of the behavior of the studied objects or the development of processes with the subsequent analysis and forecast of trends in their change; the construction of virtual worlds by using libraries of ready-made virtual objects.

3.2.3. The development of scientific and methodological support of training, retraining and advanced training of teaching and managerial staff in the use of

software, hardware and information complexes for educational purposes is forecasted in the functioning of the high-tech information and educational environment of the educational institution. In this context, the development of didactic and software-technological bases for the information interaction of students with robotic systems and devices implementing virtual reality technology, in the functioning of the high-tech information and educational environment of the educational institution determines the development of vocational education and field-specific training in the context of education informatization.

The system of network tools for the development of an electronic educational resource, the content of which assumes the implementation of the "built-in" capabilities of information technologies (computing, search, analytical, model-forming) is forecasted as an innovative means of training of teaching and managerial staff. This allows as follows:

- simulation of real (educational, professional) actions that can be operationalized and are subject to the model description with the subsequent provision of training for this type of activity;
- simulation of the dynamics of the development of the studied or research objects, processes with the possibility to analyze and forecast trends in their change or development and then ensure the information interaction at the level of information exchange (parameter data, visual images or symbols);
- simulation of information interaction with virtual objects, with the possibility of information attraction in the sphere of accumulated experience in the performance of activities (educational, professional activities);
- ensuring the information interaction with virtual objects of a certain subject area in accordance with its regularities.

4. Topics for discussion

The analysis of fundamental and applied research works in the sphere of education informatization (Vagramenko, Y.A. (2015), Kozlov, O.A. (2012), Mukhametzyanov, I.Sh. (2010), Dimova, A.L. (2016), Robert I.V. (2014a), Serdyukov, V.I. (2014) and the analysis of technical and technological innovations created by specialists (Kovalchuk, M.V. (2011), Robert, I.V. (2014b), Tikhonov, Linetsky, Sedova and Trubochkina (2014), Tikhonov, Uvaysov, Kofanov and Sotnikova (2014), Shikhnabieva, T.Sh. (Shikhnabieva, T.Sh. (2011)) initiate the development of education informatization and create prerequisites for forecasting education informatization, firstly, as a specially organized process of providing the education with methodology, theory, technology and practice of developing and optimizing the use of ICTs in health-saving conditions, and secondly, as a field of scientific and pedagogical knowledge focused on the implementation of learning objectives, the development of a student. Thus, in modern

information society of mass network communication and globalization the education informatization received a new impulse of its development, reflected in the following directions:

1. Development of learning theories in the context of education informatization in modern society of mass network communication and globalization.

2. Development and implementation of pedagogical innovations in the high-tech health-saving information and educational environment.

3. Creation and use of the information and educational space in the conditions of mass network communication of modern society.

4. Real time training of teaching and managerial staff by using information and communication technologies.

5. Application of robotic systems and devices in the conditions of the functioning of the high-tech information and educational environment of the educational institution.

5. Conclusion

1. Philosophical-methodological, medical-psychological, social-pedagogical grounds for the development of learning theories in the context of education informatization of modern society of mass network communication and globalization.

2. Psychological-pedagogical and technological prerequisites for the development and implementation of pedagogical innovations in the high-tech health-saving information and educational environment.

3. Development of the theory and methodology of creation and application of the information and educational space in the context of mass network communication of modern society.

4. Theoretical-methodical and technological support of real-time training of teaching and administrative staff in the sphere of information safety of the subjects of the educational process by using information and communication technologies.

5. Theoretical and methodical grounds for the use of robotic systems and devices in the conditions of the functioning of the high-tech information and educational environment of the educational institution.

References

Beshenkov, S.A., and Midzaeva, E.V. (2016). Informatsionnaya bezopasnost uchashchikhsya i ikh integratsiya v sovremennyi sotsium [Information Security of Students and Their Integration into Modern Society]. *Distantsionnoe i virtualnoe obuchenie, 5*, 11-18.

Kastornova, V.A. and Andreev, A.E. (2015). K voprosu ob ekspertize pedagogicheskoi produktsii, realizovannoi na baze informatsionnykh i kommunikatsionnykh tekhnologii [On the Expertise of Pedagogical Products Implemented on the Basis of Information and Communication Technologies]. *Uchenye zapiski IUO RAO, 56*, 80-91.

Kovalchuk, M.V. (2011). Konvergentsiya nauk i tekhnologii – proryv v budushchee [Convergence of Sciences and Technologies – Breakthrough in the Future]. *Rossiiskie nanotekhnologii, 6*(1-2), 13-23.

Kozlov, O.A. and Kastornova, V.A. (2012). *Teoreticheskie osnovy sozdaniya metodicheskoi sistemy podgotovki pedagogicheskikh kadrov v usloviyakh funktsionirovaniya mirovogo informatsionnogo obrazovatelnogo prostranstva: Monografiya* [Theoretical Foundations of the Creation of the Methodic System for the Training of Teaching Staff in the Conditions of Functioning of the World's Informational Educational Space: Monograph]. Moscow: IIO RAO.

Martirosyan, L.P. (2012). *Informatizatsiya matematicheskogo obrazovaniya: teoreticheskie osnovaniya; nauchno-metodicheskoe obespechenie* [Informatization of Mathematical Education: Theoretical Grounds; Scientific and Methodical Support] (2nd ed.). Moscow: IIO RAO, pp. 198.

Martirosyan, L.P., and Safonov, V.I. (2015). Podgotovka pedagogicheskikh kadrov po sovmeshchennym profilyam v oblasti konvergentsii predmetnykh oblastei matematiki i informatiki [Training of Teaching Staff on Combined Specializations in the Sphere of Convergence of Subject Areas of Mathematics and Computer Science]. *Gumanitarnye nauki i obrazovanie, 4*(24), 81-84.

Mukhametzyanov, I.Sh. (2010). *Meditsinskie aspekty informatizatsii obrazovaniy* [Medical Aspects of Education Informatization]. Moscow: IIO RAO, pp. 72.

Mukhametzyanov, I., and Dimova, A. (2016). Assessment of Levels of Formation of Competence of Students as Users of Information and Communication Technology in the Sphere of Health Care. Springer International Publishing Switzerland. *Smart Education and E-Learning 2016*, 59, 585-592.

Osnovy politiki Rossiiskoi Federatsii v oblasti razvitiya nauki i tekhnologii na period do 2020 goda i dalneishuyu perspektivu [Fundamentals of the Policy of the Russian Federation in the Sphere of the Development of Science and Technology for the Period until 2020 and Further]. (2012, January 11). Approved by the President of the Russian Federation No. Pr-83.

Perechen kriticheskikh tekhnologii Rossiiskoi Federatsii (v chasti informatsionno-telekommunikatsionnye sistemy) [The List of Critical Technologies of the Russian Federation (in the Part of Information and Telecommunication Systems)]. (2011, July 7). Approved by the Decree of the President of the Russian Federation No. 899.

Polyakov, V.P. (2016). Pedagogicheskoe soprovozhdenie aspektov informatsionnoi bezopasnosti v informatsionnoi podgotovke studentov vuzov [Pedagogical Support of the Aspects of Information Security in the Information Education of University Students]. *Pedagogicheskaya informatika, 4*, 37-47.

Robert, I.V. (2014a). *Teoriya i metodika informatizatsii obrazovaniya (psikhologo-pedagogicheskii i tekhnologicheskii aspekty)* [Theory and Methods of Education Informatization (Psychological, Pedagogical and Technological Aspects)]. Moscow: BINOM. Laboratoriya znanii, pp. 398.

Robert, I.V. (2014b). *Teoriya i metodika informatizatsii obrazovaniya (psikhologo-pedagogicheskii i tekhnologicheskii aspekty). Kontseptsiya* [Convergence of Sciences of Education and Information Technologies as Evolutionary Convergence of Sciences and Technologies (for Researchers and Teachers of Vocational Education Institutions). Concept]. Moscow: IIO RAO, pp. 54.

Robert, I.V., and Lavina, T.A. (2012). *Tolkovyi slovar slov i slovosochetanii ponyatiinogo apparata informatizatsii obrazovaniya* [Explanatory Dictionary of Words and Phrases of the Conceptual Apparatus of Education Informatization]. Moscow: BINOM. Laboratoriya znanii, pp. 108.

Shikhnabieva, T.Sh. (2011). Avtomatizatsiya protsessa obucheniya i kontrolya znanii s ispolzovaniem intellektualnykh modelei obrazovatelnogo kontenta [Automation of the Learning Process and Knowledge Control Using Intellectual Educational Models]. *Pedagogicheskaya informatika, 5*, 27-31.

Serdyukov, V.I., and Serdyukova, N.A. (2014). Napravleniya sovershenstvovaniya avtomatizirovannykh sistem kontrolya rezultatov obucheniya [Directions of Improvement of Automated Systems of Knowledge Control]. *Informatizatsiya obrazovaniya i nauki, 3*(23), 75-85.

Tikhonov, A.N., Linetsky, B.L., Sedova, T.L., and Trubochkina, N.K. (2014). Razrabotka kontseptsii, metodologii i bazovykh printsipov sozdaniya tsentra integratsii multimediinykh tekhnologii v nauke, obrazovanii i kulture [Development of the Concept, Methodology and Basic Principles of the Creation of a Center for Integration of Multimedia Technologies in Science, Education and Culture]. *Kachestvo. Innovatsii. Obrazovanie, 5*, 56-63.

Tikhonov, A.N., Uvaysov, S.U., Kofanov, Yu.N., and Sotnikova, S.Yu. (2014). Povyshenie

dostovernosti diagnosticheskogo modelirovaniya v informatsionnoi tekhnologii proektirovaniya elektronnykh sredstv upravleniya [Improving the Reliability of Diagnostic Modeling in the Information Technology of Designing Electronic Controls]. *Sistemy upravleniya i informatsionnye tekhnologii, 58*(4), 88-92.

Vagramenko, Y.A., and Yalamov, G.Yu. (2015). Kollektivnaya uchebnaya deyatelnost uchashchikhsya v setevoi informatsionno-obrazovatelnoi srede [Collective Educational Activity of Students in the Networked Information-Educational Environment]. *Pedagogicheskaya informatika, 3*, 42-51.

1. The Federal State Budget Scientific Institution "Institute of Education Management of the Russian Academy of Education" Center of Informatization of Education, 105062, Russia, Moscow, ul. Makarenko, 5/16, 1B. E-mail: rena_robert@mail.ru

2. The Federal State Budget Scientific Institution "Institute of Education Management of the Russian Academy of Education" Center of Informatization of Education, 105062, Russia, Moscow, ul. Makarenko, 5/16, 1

3. The Federal State Budget Scientific Institution "Institute of Education Management of the Russian Academy of Education" Center of Informatization of Education, 105062, Russia, Moscow, ul. Makarenko, 5/16, 1

4. The Federal State Budget Scientific Institution "Institute of Education Management of the Russian Academy of Education" Center of Informatization of Education, 105062, Russia, Moscow, ul. Makarenko, 5/16, 1

5. The Federal State Budget Scientific Institution "Institute of Education Management of the Russian Academy of Education" Center of Informatization of Education, 105062, Russia, Moscow, ul. Makarenko, 5/16, 1