ATLANTIS PRESS
Advances in Social Science, Education and Humanities Research, volume 240
2nd International Scientific Conference on New Industrialization: Global, National, Regional Dimension (SICNI 2018)

Informatization of higher education

Shangina Elena Igorevna
Department of information technologies and statistics
Ural State University of Economic
Yekaterinburg, Russia

Surnina Nadezhda Matveevna
Department of information technologies and statistics
Ural State University of Economic
Yekaterinburg, Russia

Abstract— **Among the main promising areas of development of higher education, it is necessary to highlight the problem of Informatization of education. In the new model of education computer and computer technologies play a special role as a means of obtaining information, its processing and storage. There should be a system of education that would allow any individual to quickly obtain all the necessary knowledge existing in the global information space. This becomes particularly relevant in connection with the transition to the "information community". According to scientists, such a transition is planned for Russia in 2050, for the USA and Japan – in 2020, for the leading countries of Western Europe – in 2030. Currently, there are numerous psychological and pedagogical aspects of computerization of education, allowing to apply them in the practice of teaching various subjects. The article presents the author's interpretation of mobile cloud learning (Mobile learning or M-Learning). This technology is the next stage of development of E-Learning. Modern research shows that the introduction of mobile devices in education leads to important qualitative changes in educational practice. First, mobility-class boundaries are "stretched" to the limits of wireless network reach. Secondly, social interaction, i.e., to the traditional oral and written interaction is added to the data exchange, creating a shared resource telecommunications projects, etc. third, the individualization of the educational trajectory, pace, and intensity of training. Fourth, susceptibility to educational space. Fifth, connectivity, creating a universal environment of network interaction, binding. Sixth, the creation of interfaces between the physical and digital worlds using sensors, sensors, GIS, etc. Disclosed methods and learning principles considered by the pedagogical system model of mobile cloud learning, the results of the experiment on introduction of the components of mobile cloud learning. Theoretical studies are verified. It is shown that the proportion of students willing to learn through the mobile-cloud using a wireless access increases and these technologies are effective.**

Keywords—mobility, mobile cloud learning, mobile education.

I. INTRODUCTION

The Informatization of society in all spheres of public life, including education, reveals the problem of the use of computers. The use of computers in training should not cancel training in the real subject direction, because the computer is only a means of increasing the efficiency of intellectual human activity, and therefore it is unacceptable to replace real physical phenomena only with a model representation of them on the computer screen. The fundamental principles of the activity of the concept of formation of the psyche created by the writings of prominent psychologist of L. S. Vygotsky, S. L. Rubinstein, P. Y. Galperin, reveal the relationship of mental and practical human activity: the psyche, consciousness, not only manifested, but also formed in the process of external human activity. If the primary images, ideas, concepts are external objects, then the primary for the psychological, mental actions are the external, material actions, and, most importantly, the material itself is the subject, not other people. Using a computer cannot change the laws of formation of the psyche, consciousness, mental actions. Today, as a hundred years ago, a person, learning to count, first manipulates various objects (shifts sticks, bends his fingers), performing an external action, and only then these operations are performed in the mind. And immediately get the elements of mental activity in the internal plan is impossible. Knowledge, skills and abilities can be acquired only within the framework of their own practical experience, because education is not the translation of information and not even so much an appeal to the human intellect, as an appeal to the feelings, to the individual and unique world of man, to his worldview.

Therefore, the question of the whole multidimensional and multifactorial problem of Informatization of education is relevant. It should be noted here that the very idea of the information paradigm of education has already led to negative consequences. Nevertheless, the rational use of computers in the learning process is effective and fills the activities of the teacher with new content, allows to individualize and differentiate the learning process, stimulate cognitive activity and independence of students.

II. EFFICIENT USE OF COMPUTERS NOWADAYS

In our opinion, the use of computers is manifested in the following stages of the teaching process.

1. At the stage of presentation of educational information to students. This is due to the fact that the unity of ideas about the concepts of real physical and abstract geometric spaces is

the basis of cognitive processes, because human cognition goes "from live contemplation to abstract thinking and from it to practice", for example, the study of the theory of geometric modeling, followed by its visual application to the problems of practice on the computer. Academician A. D. Alexandrov saw the main feature of geometry in combination of strict logic with visual representations, in combination of ideal geometric objects with clearly presented things, and therefore considered it necessary in the teaching of geometry to associate it with real objects.

2. At the stage of assimilation of educational material in the process of interactive interaction with the computer. One of the reasons for underachievement of students is that they cannot isolate the semantic core of the educational material from a large amount of educational information. Training can achieve a lot. Academician p. K. Anokhin wrote that "a Researcher should often keep in mind several logical chains at the same time, remember a large number of different facts. Often the truth can be born only with the simultaneous combination of several processes. Many young researchers are often frustrated here, they have poorly developed, as it is called by psychologists, simultaneous thinking (in English “simultaneas” means simultaneous). It turns out depressing picture: if the truth is hidden in the five or six components, the majority of researchers, not having simultaneous thoughts just physiologically cut off from it" [1, p. 257]. Revolutionary changes in the element base of computers that have occurred over the past 20 years have led to a sharp increase in the accuracy and speed of their work, the expansion of logical, heuristic functions, and to a certain extent-creative. As a result, the student can simultaneously compare different types of educational information, allowing to highlight its features and invariants.

3. At the stage of repetition and consolidation of acquired competencies (knowledge, skills, abilities). Knowing the process of formation of new information and all the difficulties associated with this process, the teacher should teach students to overcome these difficulties. The main criterion is a clear phasing in the work. Only after the full completion of one stage should move on to the second, as this creates a prerequisite for the successful development of the next stage. The incompleteness of each of the stages reduces the interest in work, since there are no conditions for the maximum manifestation of mental possibilities. For example, the teaching of computer graphics, which takes place in the second year, shows that students who have not mastered the basic provisions of descriptive geometry and engineering graphics in the first year, cannot work with graphic computer programs.

4. At the stage of intermediate and final control and self-control of achieved learning outcomes. The creation of computer programs for the assimilation of knowledge with the obligatory consideration of the specifics of the content (scientific information), as well as the regularities of the assimilation of this information by a specific contingent of students, will allow to individualize and differentiate the learning process, increase the independence of students.

Thus, it can be concluded that an integral feature of modern education is its Informatization. The use of computers should not cancel the training in the real subject direction, i.e. the replacement of real physical objects (phenomena) only by the model representation on the computer screen is unacceptable, which in the long term can lead to a decrease in the intellectual potential of future specialists. Strengthening the Informatization of the content of education and the widespread introduction of information technology in the educational process requires alignment of the dynamics of development between the information and fundamental direction of education. Any computer-just a means of improving the efficiency of intellectual human activity, performing purely auxiliary functions of providing the possibility of objective educational information that helps the teacher and the student in the implementation of the goals of development of thinking.

In the context of the unfolding process of Informatization of the educational sphere, which is a natural reflection of trends in social development, computer visualization is considered as a generalization of different ways of presenting educational information. After all, visualization provides mobilization of resources of imaginative, logical, complex thinking of the student, as well as other important properties and qualities of his personality. At the same time, in the conditions of wide spread of cognitive models and methodological approaches in science in General and their demand in pedagogical activity in particular, the question of studying the cognitive potential of computer visualization in the sphere of higher professional education and identifying new properties of didactic visual means that activate the personal potential of students is particularly relevant.

The embodiment of the cognitive component of computer visualization of educational information in pedagogical practice determines the optimization of the educational process, accompanying the information interaction of its subjects, evaluation of learning outcomes, maintaining high rates of learning, memorization and comprehension of knowledge; allows to realize the holistic perception of educational material by imagination; helps to understand more deeply the connections between phenomena; it provides a better understanding and contributes to the generation of new knowledge, as well as the development of such important qualities for a specialist as the intuition of a holistic "grasp" of the situation, professional "flair", creative thinking, etc. Thanks to the computer support and maintenance of the system of technological methods and techniques of display and analysis of knowledge in visual form, the educational process becomes more manageable, programmable, arbitrary, instrumental savings, projective modeling, and therefore objectified, predictable, programmable and providing a sustainable learning outcomes. At the same time, due to the fact that an integral component of the qualification requirements of the future specialist is a skilled, specialized vision, called "experienced look" or "professional vision", technologies and visualization tools that provide optimal and effective perception, assimilation and use of educational information, are used as effective tools for solving educational problems of the system of higher professional education, among which: the formation and development of critical and visual thinking, visual perception of students., imaginative representation of knowledge, learning activities, knowledge

transfer and pattern recognition, improving their visual literacy and visual culture, and others.

The effective solution of these tasks is carried out within the framework of teaching various academic disciplines of educational programs in accordance with their content, objectives, adopted methods, means of training. However, special attention should be paid to the course of computer graphics, focused on intensive and multidimensional interaction with the phenomenon of computer visualization of educational information in the electronic geometric model. This discipline presents unlimited opportunities for the disclosure of cognitive and educational potential of the phenomenon in the education of qualified engineers. The interdisciplinary approach underlying the teaching of the course allows to find appropriate forms and methods of education relevant at the present stage of social development.

III. New Technologies in Higher Education

Currently, many areas of life are permeated with innovation. A serious factor that stops the innovative development is the human factor. In our opinion, a person is poorly involved in the innovation process as an active participant, source and conductor of innovative ideas. We are talking about the national system of innovative education of future specialists with their subsequent inclusion in the innovation process. One of the innovative technologies is the necessity of rational introduction of modern means of educational information transfer into the educational process. These factors have led to the need for new forms of education, more flexible and mobile. In the XXI century mobile learning as a new direction is emerging. Mobile learning uses mobile wireless devices (smartphones and tablets) as learning tools. They fundamentally change the way knowledge is acquired and allow access to unlimited information at any time. The introduction of mobile devices is an irreversible reality of modern education [9].

In the conditions of intensive processes of information to the fore the problems of education aimed at the solution of many problems, one of which is increase of efficiency of independent work of technical University students using Internet technologies. Our analysis of the scientific literature suggests that the identification of the possibilities of using Internet-technologies in higher education is a promising field of research in pedagogical science. In addition, the technical tools that are used in various fields of science and daily life has brought new possibilities into our lives and thus in the system of training and education. This led to the development of a new trend in education called "mobile-cloud" (Mobile learning or M-Learning) using mobile phones, smartphones and pocket portable computers. This technology is the next stage of development of E-Learning. Technology M-Learning assumes the existence of a system of education which should include a subsystem of access to learning materials and services from various mobile devices, and the availability of web-access. Mobile learning is a new educational technology in the digital era, created thanks to wireless technologies supporting flexible, accessible, personalized education.

IV. Methodology of M-Learning

First, Mobile cloud learning technology mean technology that allows you to organize the learning process using mobile devices such as smartphone, handheld portable computers, laptops, gadgets, etc. [2, p. 23]. Model M-Learning is based on the basic pedagogical principles and potential resource of information and communication technologies (Fig. 1).

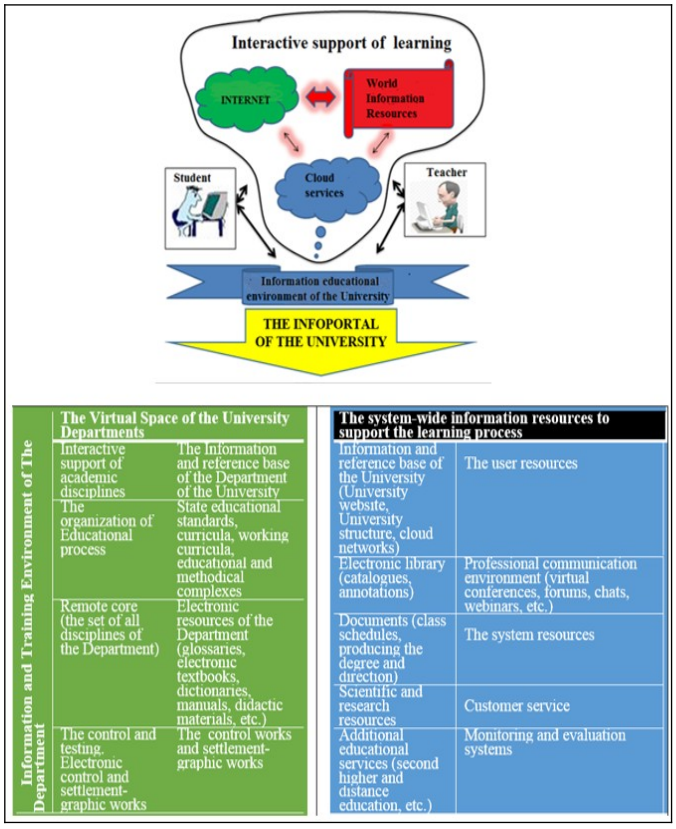

Fig. 1. The Model M-Learning.

It includes a specific algorithm of actions of teacher and student, based on an ordered set of stages of the learning process through the General and(or) personal learning-structured learning resources, activities of educational associations. In the process, mobile cloud learning to change the verbal, visual and practice-oriented teaching methods. Verbal methods (lecture, explanation, conversation, discussion, consultation, etc.) multimedia technology presented in the form of audio-, video-, graphic elements, hypertext, hypermedia, mediality, slide lectures, live or recorded audio (podcast), blog, forum, chat, video conference. Visual methods mobile cloud-based learning are implemented cognitive visual images through medially, video, hypertext, hypermedia, interactive maps, visual-figurative, geometric and graphic models, interactive computer workshops, interactive whiteboard and graphics tablet [2]. Practice-oriented methods (exercises, laboratory and practical work settlement and graphic works and tests) can be implemented using the computer lessons, interactive tests, computer trainers, simulators, etc.

Principles of M-learning are the following. Accessibility – M-learning environment provides access to content (information meaningful or substantive content of the information resource), and also suggests the mechanism of interaction with other participants in the learning process – students, teachers, coaches, and sources of necessary information (documents, textbooks, manuals, standards, programs, etc.). Mobility – implementation of the learning process is possible only in the presence of and by means of mobile cloud-based learning environment: a smartphone or tablet, laptop or directly from a computer class in full-time education at any time and in any place. Cloud – the mechanism of mobile cloud-based learning environment due to the tool implement information in a cloud. Cloud access provides a consistent use of materials of the discipline of study, providing a wider range of reliable information. Integration – mobile-cloud-based learning environment is a combination of physical (traditional) and digital (non-traditional) approaches, and diverse forms of obtaining and understanding information, providing them with quality knowledge and competence in the learning process. Mobile cloud learning environment will always represent a combination of components of communication in the implementation of the learning process: physical, personal and digital contact.

Contact– relationship of all participants in the process, mobile cloud learning, i.e. cooperation with the teacher and with students in a specific discipline, because they have the opportunity to establish contact with local and global communities through social media platforms Twitter, Facebook, VKontakte, Instagram for discussion and therefore deeper understanding of the information. Personalization – M-Learning assumes the form of training of participants in the process of receiving and assimilating the information "1 member – 1 device". The information content corresponds to the original source, not subject to interpretation, and, as a result, provides an experience that is truly personalized. Stability – the constant need for access to information in the learning process, cognitive activity associated with learning via mobile devices. Synchronicity – parallel interaction with any information, ie. information educational environment of the University extends to the global information resources, allowing participants to process mobile cloud learning to move in any place, any time searching for needed information using individual capabilities (knowledge of the language, content, mobile communication, etc.). Adaptability – mobile-cloud technology its structure is consistent with student learning activities (store files, generate ideas, support students in the learning process). Combination – joining the learning process at any time, in the right place and for a particular person, when students independently plan the theme, through the application and through interaction with teachers. Hierarchy – mobile-cloud technologies due to a variety of content, so designed for a different audience, different age, intellectual development, specific discipline, scope, and possibilities of its practical and theoretical applications, etc. This also suggests that mobile cloud-based learning environment students are confronted with diverse and often unplanned information and the parties to the communication. These technologies allow to increase interest to the student and thereby convert the form of academic training in student-centered and learning through play.

M-Learning is impossible without information literacy, on the part of the teacher and the student. The concept of "information literacy" as a tool of information activities not only use a computer and look at it in a number of concepts related to information and computer technologies (computer, information, etc.). Information literacy is an indicator of human development because it promotes self-education and obtaining skills of a member of the information society, electronic services consumers. Information literacy is a concept that brings together the following important groups of competences.

Computer competence. Widely used as one of the objectives of vocational training in a technical University. This concept we understand as information technology competence, which is the synthesis of knowledge and skills to operate the computer, the manifestation of the experience on the computer. It represents the integrated characteristic of future specialists, involving the motivation to master the relevant knowledge, ability to solve problems in academic and professional activities using computer equipment and possession of methods of computer thinking. Computer competencies are developed both at the stage of studying the computer and its use as a means to further learning, professional activities and is regarded as one of the faces of personal maturity.

Information-communicative competence – the system property of the personality (subject) of the student to navigate the flow of information, as the ability to work with different information sources, locate and select the required material, classify it, summarize, critical to treat it as a skill based on acquired knowledge specifically and effectively address these problems. Information-communicative competence is perceived as a fundamental component of information culture, which, in turn, is part of the General culture of the individual. This competence characterizes deep knowledge of the subject and the personal experience of the subject, aimed at promising work on the development of knowledge on the development of modern scientific worldview and personality of the student. The student must be open to dynamic enrichment and self-improvement through the acquisition, evaluation of information and the ability to create new information. The student should be able to achieve significant results in educational and professional activities.

Interdisciplinary competence, which in addition to the knowledge, skills and abilities include the following qualities: understanding of the connections between different disciplines and the willingness to use knowledge from one of the disciplines in the study of others; the experience of the integrated application of knowledge in the relevant disciplines in the study of others; the level of conscious application of knowledge to professional activity, based on knowledge of the various disciplines; student confidence in their ability to solve

tasks of professional activity, comprehensively applying knowledge in different disciplines; willingness to study and obtain new knowledge from other disciplines and activities; free orientation in the environment of information technology.

Information literacy includes the component of communication as a set of custom skills to use the services and suggestions that are supported by the computer and distributed via the Internet. The other component is information that focuses on key aspects of the society based on knowledge, i.e. the ability to optimally locate, obtain, select, process, transmit, create, use and store digital information.

V. The Results of the Implementation of M-Learning

We carried out the experiment on introduction of the components of M-Learning in the discipline "Computer graphics" (date from October till may 20016-20017). Developed a set of tools for M-Learning are: 1) electronic educational resources (EER); 2) electronic educational and methodical complex (EUMK), which includes: the working curriculum on the subject; mattabesett discipline), the electronic version of the print edition (EUMK); models of control tasks and questions (tests) for individual modules of discipline; a set of examination papers; the list of teaching materials for different forms of training sessions on discipline; 3) electronic textbook (co-authored); 4) a set of six computer workshops: 5) a presentation. In addition, developed an electronic computer learning systems, audio – video teaching materials, databases and electronic library with remote access. In addition to traditional electronic textual and graphical information, the learning process includes multimedia, namely animation, sound, video, color. These options provide greater clarity and receptivity and, as a consequence, the assimilation of student learning material. Comparative analysis of student performance confirms the positive dynamics of progress: in the control group (62 persons) number of students learned the training material on "positive", was 40.3% in the experimental group (66 people) - 52.6 %. The percentage of students not learned the training material and the control group is 12.4%, in the experimental group and 8.7%. The survey of 150 students and 20 teachers showed accumulation of technical and personal readiness of students for the use of innovations: the percentage of students willing to learn through the mobile-cloud using wireless access (subject to an acceptable cost) access is 54%.

VI. Conclusion

Currently, many areas of life are imbued with innovation. In the development of instructional media, mastering tools mobile-cloud technologies can be considered as an indicator of innovative culture and professional training that corresponds to the general trend of development of innovations in the field of education. With the competent and structured use of mobile technologies in the learning process, it is possible to bring education to a new level, and accordingly, to increase the level of education of the population. Since mobile technologies allow us to penetrate to the most remote part of the world, at any time and in any place.

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