Problems of the Intelligent Virtual Learning Environment Development

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Abstract. The modern ways to increase the efficiency of education, which includes the development, implementation and use of intellectual virtual learning environments (IVLE), which would include virtual reality systems, information, design, interactive, training, gaming and other learning technologies are considered. Approaches to the simulation of training in the IVLE are offered and analyzed, before carrying out professional, didactic and methodical analysis of educational material; from the technological point of view, it is suggested that it is expedient to include the entire educational material necessary for the acquisition of certain knowledge, skills and abilities for the IVLE to form the general and professional competencies of students, in accordance with the curricula and programs; It is proposed to implement flexibility, adaptability and integrity of the IPNS based on the principle of hierarchy of complex systems. It is researched that the modeling, implementation and use of information technologies in education changes not only individual actions, but also human activity in general, affecting all mental processes, as there is indirect activity with new sign systems and means that requires additional psychological efforts from students, and from teachers - the use of new methods and methods of training; the interconnected and interconnected combination in the process of learning real and virtual is analyzed, which will allow to ensure the efficiency of modern teaching technologies that provide for the proactive character of personal development. The main tasks and functions assigned to the IVLE are presented in the form of a tree of goals and are aimed at increasing the effectiveness of learning through the construction of virtual universities in the information society and, accordingly, a new education system and its new paradigm.

Keywords: Virtualization, Knowledge, Intellectualization, Modeling, Learning, Environment

1 Introduction

The content and quality of higher education today depend on its level of virtualization [1], which involves the transfer of knowledge through technical media mediators (Internet distance learning platforms, multimedia technologies such as audio and video communication, the ability to use musical accompaniment, audio - video clips, simulation of various objects and processes in 3D space and other forms of information and communication technologies, etc.). Virtual education systems in Ukraine are mainly oriented on Internet technologies and combining various traditional forms of daytime and distance education with technological Internet innovations.

Computerization today, accordingly, covers only a part of the educational process and does not use all the positive aspects of virtualization of learning, in particular, the possibility of establishing a qualitative imitation of natural, technological or economic processes, the interconnected use of virtual and real learning for the development of professional skills, especially relevant for fundamental sciences, natural sciences, technical and economic specialties. It should be noted that the growth of information volumes today also causes the change of priorities in the system of training and retraining of personnel, the use of the latest forms and methods of training, since according to the OUN expert commission, the person only remembers about 10% of the read, 20% of the heard, 30% see you If a person hears and sees, the level of memory increases to 50%. If she is hearing, seeing and discussing, then the memory level reaches 70%. The use of audiovisual media reduces the time required for training by 40%, increases the amount of information that is acquired by 20% [2]. Therefore, the modern direction of improving pedagogical efficiency in the system of university education can be assumed to be the development, implementation and use in the universities of IVLE, which would include modern learning technologies, in particular [3]: information, design, interactive, training, gaming and others.

Analysis of recent research and publications. A study of the problems of the virtualization of education devoted a lot of domestic and foreign scholars to their scientific work [1-19]. M. Murashko and S. Nazarko [1] believe that the virtualization of education involves the transfer of knowledge through technical mediators (Internet distance learning platforms, multimedia and other forms of information and communication technologies, etc.). A. Karlov [4] argues that the virtualization of education increases its efficiency, reduces its costs and makes it more widespread and accessible. M. Klement [5] suggests using a virtual learning environment and multimedia as a means of activating the learning process where a good result can be achieved by combining classical learning with modern computer technology. D. Lunsford [6] believes that the virtualization platform VMware Workstation 6, which provides multiple virtual machines on one physical platform, can be used as an effective tool in the learning process for: easier assimilation of complex topics; integration of topics and courses; Providing students with easy access to a variety of practical classes. However, Dale L. Lunsford focuses on the fact that virtualization leads to awareness of the limited virtual environment and careful planning of choosing the right tools for their individual abilities. V. Pashkov [7] believes that virtual teaching aids is one of the main mechanisms for changing the professional, life-styles of the teacher and the student at the level of everyday behavioral practices and at the level of fundamental ideological paradigms. SG Litvinova [8], under the virtualization of the learning process, understands the use, development of software and the preservation of any objects in cloud storage, in particular: documents, virtual classes, laboratories, libraries, maps, etc., and suggests the basic principles of constructing a cloud-based learning environment. include: focusing on the interests and needs of participants in the educational process, unified technical standards and interoperability, confidentiality and information security, openness, international compliance m standards, volunteerism, hierarchy, collective use of data, copyright, instant response. T. Słaboszewska [9] suggests using the virtual reality environment in the learning process, which greatly enhances motivation, encourages students to focus on key aspects of learning content, helping them develop practical and professional skills, provoking cognitive and emotional activity. Under virtual reality, here

is an image that is modeled by technical means of the artificial world, transmitted to a person through the feelings that are imitated in accordance with this image, and virtual reality technology involves the production of high-quality stereos images, the creation of devices to influence other (other than view) channels of information receipt in the human brain with appropriate feedback and software development that allows you to create the necessary real-time images. Irina Melnyk, Nadia Zaderey, Galina Nefyodova [10] believe that the future of the physical real world will be formed by mergedreality (MR), based on the addition of AR and the virtual VR reality. Virtual reality (virtualreality, VR) is a world created with the help of special technical means, which enable every student to fall into this fictional world. Enhanced reality (augmentedreality, AR) is a technology in which the user's representation in the real world is enhanced and supplemented by additional information of computer models that allows the user to stay in touch with the real environment.

Thus, the analysis of recent researches and publications suggests that the problems of the development, implementation and use of ICS in the system of university education, the solution of which is based on a synthetic approach and is relevant in the context of the construction of an information society, has not yet been systematically investigated.

The aim of the article. To propose modern approaches to the construction of intellectual virtual learning environments in the university education system.

2 The Results of Research

It is expedient to develop, implement, and use the IVLE in universities because they: on the one hand, using Internet technologies, can form university virtual learning environments or virtual universities and integrate into the global educational space; on the other, as human-computer systems, are based on the synthetic approach and use the natural and artificial intelligence of the educational process, a combination of virtual and real. In the work, the main focus is on the research of IVLE as human-computer systems that function in the dialog mode and help to solve many didactic tasks, facilitate the organization of training with a high level of individualization, create conditions for systematic verification of the learning of the material, accounting and assessment of knowledge, the formation of training stories and the creation of their machine archive, the establishment of effective feedback in the process of training, facilitate the formalization of evaluation processes, analysis and forecasting of training effectiveness, optimization of teaching methods. That is, IVLE can collect, process, evaluate and analyze learning information, and thus support the decision-making process regarding the level of learning and the choice of the best teaching methods for each student.

Learning in the system of university education can be regarded as a two-way activity aimed at learning and comprehension of the teaching material and the subsequent application of the acquired knowledge, skills and abilities in practice, ie, the bilateral activity of the teacher and student, or the "teacher-student" system, which is covered by bilateral communication (direct and reverse). For direct communication channels, the student receives instructional information, and the feedback channel receives the initial information, first, to the teacher, which enables him to assess the level of student's training, and secondly, to the student, to self-assess the level of training in the implementation of self-study. The inconsistency of the input and output information coming to the teacher leads him to apply it by adjusting the effects and thus affect the cognitive activity of the student.

Effective management of the level of training in the "teacher-student" system is the main goal of management. Therefore, for the effective functioning of the "teacher-student" systems, it is necessary to create such training management systems that would be based on the principles of building management systems in general, implementing modern learning technologies and supporting processes for making optimal decisions. The basic principles of organizing the work of such systems can be considered [11]: the selection and analysis of educational material, its placement in logical sequence, in accordance with the didactic rules; submission of educational

information in the form of separate, logically completed doses, with the provision of percepts and constructs; phased control of assimilation with the change of types and forms of verification; individualization and optimization of the pace and quality of education; creating learning stories; application of technical means for the submission of information and control of its assimilation; support in decision-making on management and self-regulation of cognitive activity of students on the basis of constant feedback; conducting and publishing training protocols.

The development of educational systems today is possible due to the transformation of the "teacher-student" system into the "teacher-IVLE-student" system (Fig. 1), where the teacher is assigned the role of a creative component, which makes final decisions and manages the IVLE-student interaction process. The components of IVLE are the following systems: training, which consists of the required number of computer training programs that implement the learning process and can use in the learning of interconnected and interconnected combination of virtual and real; control of learning outcomes; processing results of control; assessment and forecasting of learning effectiveness; withdrawal of training protocols; database management system and database; information and reference and expert systems. When constructing a learning system, you can use different types of virtual reality systems, the delimitation of which lies in the plane of the methods and modes of their interaction with the user, in particular: Window to the World (WoW) or desktop BP (Desktop VR); Video Mapping (Video Mapping); Immersive Systems - perfect BP - systems that completely immerse the user in the virtual world, creating a sense of presence; remote presence systems - the connection of remote sensors, located on any object in the real world with the operator-man; Mixed Reality Systems is a combination of remote presence systems and a virtual reality based computer whose image is generated based on information extracted by sensors of remote presence systems [12]. The structure of an expert system that is capable of accepting and justifying the solution and which can be attributed to systems of artificial intelligence include: subsystems of accumulation of knowledge of the first and second kind, knowledge base, knowledge management system, subsystem of acceptance and explanation of decisions. These systems are integrated into the IVLE using the system interface. The interaction of the student, teacher and expert on the IVLE is carried out by the means of the corresponding interfaces.

The basis of the intellectualization of the management of the educational process by means of the IVLE is the general principle of the organization of management systems, according to which object management is carried out in three stages: the display of information status of the object of management; formation and decision making; realization of the taken decisions. The necessary decisions with the use of IVLE will be made on the basis of knowledge of experts, which, accordingly, can be highly qualified specialists in specialized branches of knowledge (knowledge of the first kind), as well as knowledge gained on the basis of a priori information and results of research of scientific and pedagogical activities of universities (knowledge the second kind). This knowledge can be formalized by a knowledge engineer and entered into the knowledge base as a virtual knowledge, on the basis of which will be made appropriate decisions. That is, the proposed IVLE is focused on the study of specialized disciplines, and their aggregate, using Internet technologies, can form a university virtual learning environment or virtual university and integrate into the global educational space [13].

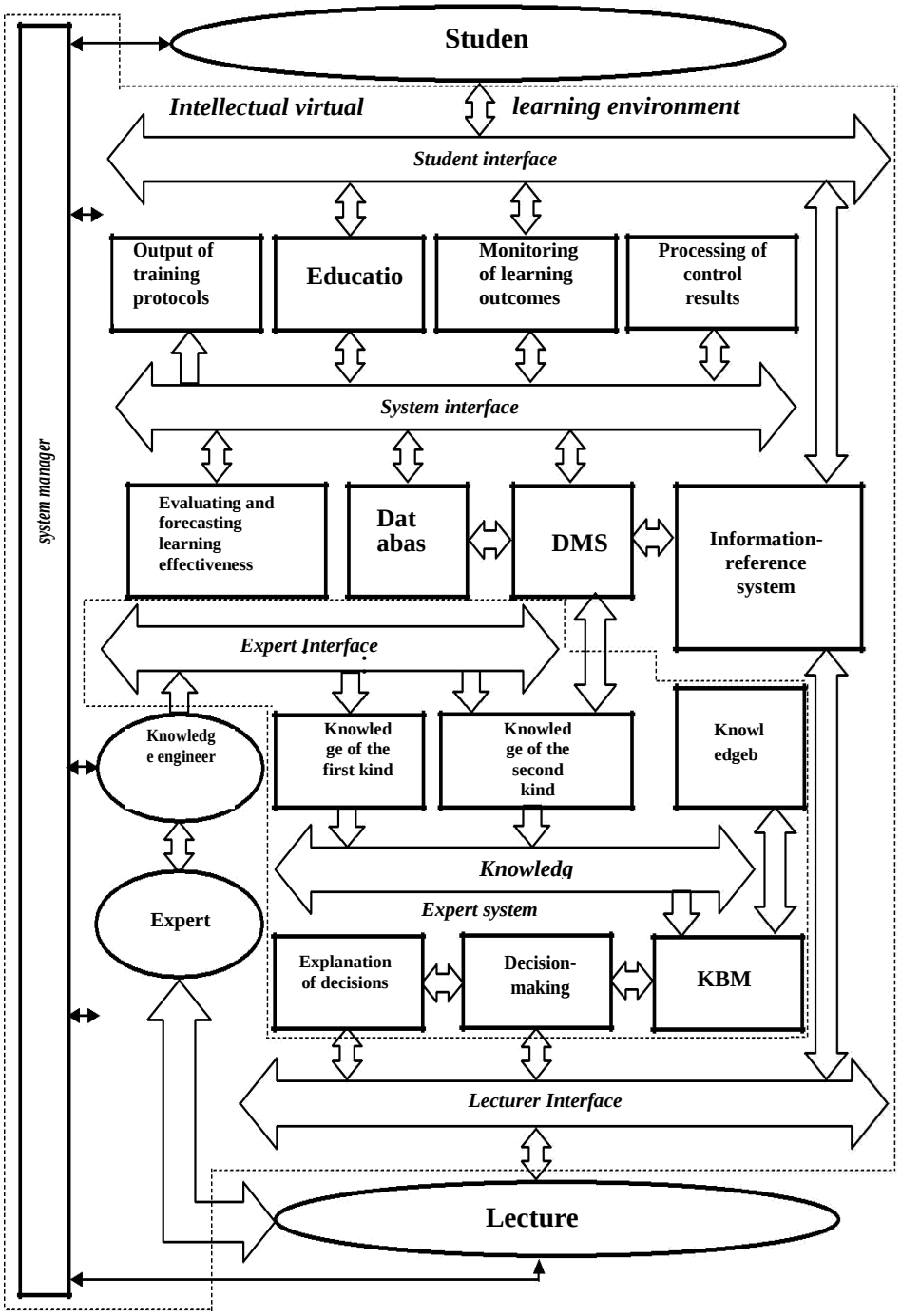

Fig. 1. Organizational structure of the "student-IVLE-teacher" system

The simulation of training in IVLE is proposed to be implemented as follows: modeling the content of training (curricula and programs); modeling the processes of forming competences in accordance with curricula and programs, training knowledge and skills; modeling of processes of control of competences, mastering of knowledge and skills; formation of databases and knowledge bases; modeling of database management systems and knowledge bases; modeling the states of the educational process, studying their dynamics; modeling of processes for supporting acceptance and substantiation of decisions, teaching management. Simulation of education, in turn, leads to the implementation of professional, didactic and methodological analysis of educational material.

The professional analysis of the training material consists in a detailed analysis and selection of the content of the training information that students need to master in the study of a certain discipline, section, topic (here should proceed from standard requirements and professional specialist), in determining the sequence of studying discipline and highlighting the main themes of the circle the questions included in them.

When developing software, it should be borne in mind that in the short-term memory of the person information is stored for no more than 30 seconds [2]. Increasing this interval and transferring information from short-term to long-term memory can be a continuous repetition, so the core components of learning knowledge should be repeated from program to program, but in a different form and tendency to curtail and synthesize.

One of the psychological features of IVLE should be the ability to control (self-regulation) cognitive activity of students. The IVLE indicates the direction of human activity (the system of finite and intermediate goals) and the system of perceptual (perception actions), mnemonic (memory action), thoughtful, graphic actions and operations, as well as criteria for the effectiveness of their implementation.

This information will help the student more effectively manage their cognitive activity. In addition, constant positive reinforcement of training, facilitates the consolidation of knowledge and skills of the student, stimulates his readiness for further work (motivational factor). Didactic analysis of the selected educational material consists in choosing one of the forms of his presentation, the form of student communication with the material.

A direct link channel is: a monologue message of the same or a new study information for all students; an individualized message that provides tailor-made training through adaptive training modules; a composite message that combines the application of a single module of the first two forms. The feedback channel is: a system of questions, tasks, tasks with a selective response form that provides constant external and internal feedback.

Methodological analysis is to choose the learning algorithm that is the same for all students or individualized, based on the individual capabilities of each student. Here we are talking about the dosage of educational material, the optimal amount of elementary learning step as a logically completed section of the curriculum and a frame or "dose" as a structural element of the "step"; the formulation of intermediate tasks, questions and expected answers for operational control and self-control of student knowledge. In this case, the size of the step can also be dosed.

From the technological point of view, it is advisable to include in the IVLE all the training material necessary for the acquisition of certain knowledge, skills and competences for the formation of general and professional competencies of students, according to the curriculum. The content of each "step" of learning should contain new material (basic concepts, relationships, properties) that needs to be learned and remembered. In terms of content, this should be logically complemented by the amount of training information. Each "step" should consist of an optimal number of staff, which would contain educational material for perception, comprehension and mastering of knowledge and skills. Therefore, the frame may be information, operational, control or mixed, to contain, for a better assimilation, no more than one cognitive operation or learning action.

It is proposed to ensure the flexibility, adaptability and integrity of the IVLE by constructing the software structure of the IVLE based on the hierarchy of complex systems [14]. The hierarchy provides the IPNS with the flexibility of the software and information support structure, enhances the capabilities of the IVLE by increasing the levels of the hierarchy or elements at levels that makes them more reliable and uniform, contributes to the multi-level modeling of different learning technologies, as the modern period of education informatization is characterized by the search for such ways of creating the IVLE, which would correspond to the new paradigm of education and take into account the psychological and pedagogical peculiarities of students' behavior in these environments the specifics of the disciplines.

The use of virtual reality systems allows for inclusion in the learning process of the game elements that make it interesting and easy enough for learning to be discovered. Computer-based surveys, task-solving, writing essays, and searching for information, and even processing the results of experiments on the computer screen, increase the interest in learning because modern students are well-informed and have the relevant skills to work with different software tools, technologies and systems. At the same time, in the era of building an information society, an urgent task is the competent organization of training and minimization of the negative influence of computer technology on psychosomatic health of students. Students need to realize that the computer is only part of our lives, which helps to deepen the real world, but does not replace it. In our opinion, it is very relevant today to study the psychological and pedagogical problems of interrelated use in teaching virtual and real, their influence on the formation of students of higher educational institutions of such qualities that would allow them to successfully adapt to the conditions of the environment and influenced the development of their intellectual, creative abilities, to work with diverse sources of information and to acquire skills for independent mastering of new knowledge. By studying the psychological and didactic aspects of the influence of systems of virtual reality and information and communication technologies in general on the process of studying in the system of university education, taking into account the peculiarities of disciplines studying the laws of the real world, one can distinguish the following psychological and pedagogical problems [1,4-13,15-17], whose research is the basis for the creation of the IVLE:

- virtualization of educational environments, the formation of virtual universities, examples of which may be the Spanish "National University of Distance Education", the Educational Information Consortium "Phantom Project", the British "Open University"[18-30], etc., do not replace traditional forms of work in the usual environment of personal interaction, but increases its efficiency and adapta- bility to new conditions;
- scientifically grounded use of virtual learning technologies[31-35] can lead to the forma- tion of a fundamentally new system of education, its new paradigm, where the pur- pose of learning is not only the mastering of a certain amount of knowledge, but their focus on solving the actual theoretical and practical problems, the formation of the student's personality, intellectual level;
- the introduction and use of information technology in education changes not only individual actions, but also human activity in general, affecting all mental processes, mediated activity with new sign systems and means occurs, therefore the use of IVLE training should be gradual, which will promote students adapt to the new conditions of learning, and simultaneously, in order to minimize the nega-tive impact on the psychological state of students, it is necessary to teach them to interact with the virtual world as a model of the real world;
- use of all possibilities that the IVLE (modeling, audiovisual, etc.) in general, in order to increase students' interest in learning, development of their mental (cogni-tive) processes: sensation, perception, imagination, attention, memory, thinking;
- preparation of the teacher for introduction into the system of training of virtual objects in order to prevent the development of students of virtual addiction, the teacher must be able to control emotions of students, to create a friendly atmos-phere in classes, to form students' ability to make decisions independently, skills of constructive communication;

- to take into account already formed individual characteristics of students, their skills in work in virtual systems and at the same time to promote the development of cognitive and creative abilities, to develop the skills and skills necessary for the student to realize their own trajectory of learning and development in general;
- use in the educational process of real experiments and computer simulation experiment, which are complementary ways of studying real objects, phenomena, laws and laws, their practical application;
- use in the system of an educational experiment research with real objects, introduction of laboratory workshops, demonstrations and other types of research using computer technology;
- individualization of the process of mastering the necessary amount of professional information, a significant acceleration of the process of adaptation to the requirements of the new workplace, the formation of a new information culture in the context of developing a culture of independent search and perception of information.
- the main tasks and functions assigned to the IWLE are aimed at increasing the efficiency of learning through the construction of virtual universities in the information society and, accordingly, the new education system and its new paradigm, can be presented as a goal tree (Fig. 2).

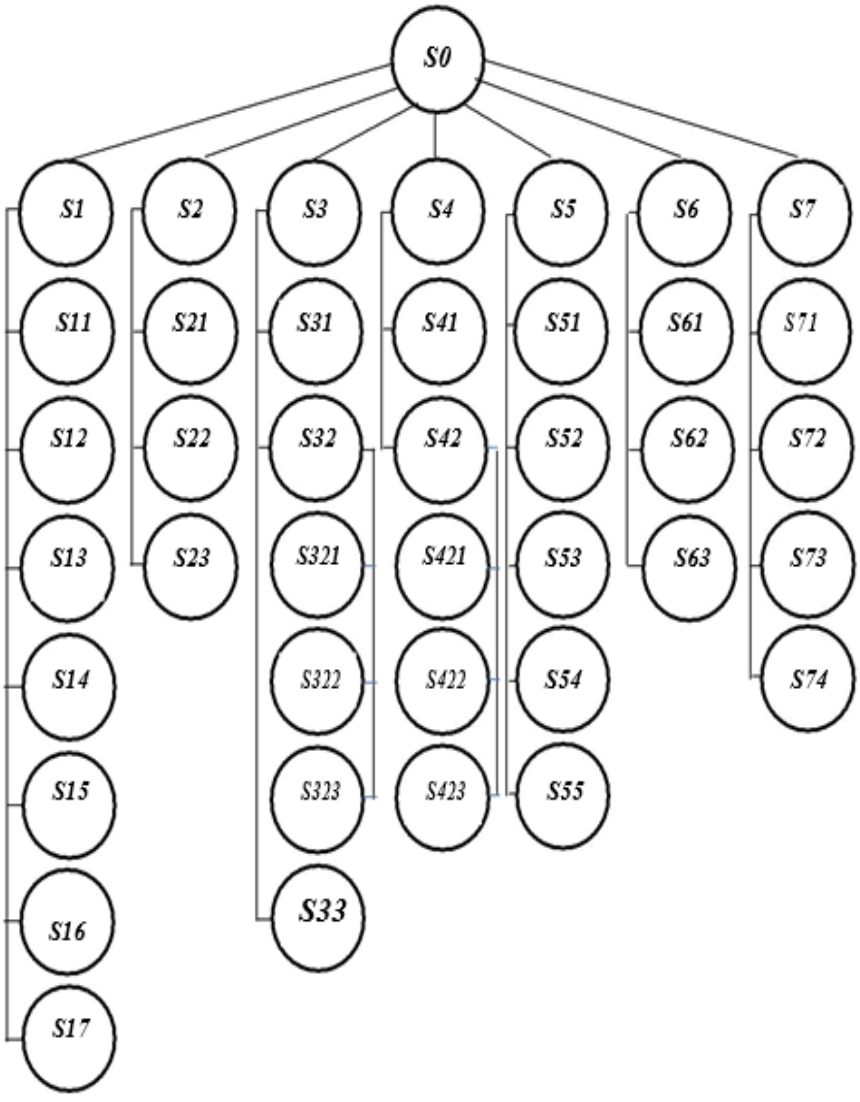

Fig. 2. Tree of the goals of the IVLE

The vertices of a given tree can be: S0 - increasing the effectiveness of learning; S1 - modeling of learning (S11 - modeling of learning content (curricula and programs); S12 - modeling of competency development processes; knowledge and skills training; S13 - modeling of competency control processes; knowledge acquisition skills; S14 - database and knowledge bases modeling; S15 - simulation of database management systems and knowledge bases; S16 - modeling the status of the educational process, studying their dynamics; S17 - modeling of processes for supporting the acceptance and substantiation of decisions, training management); S2 - the formation of competencies (S21 - the formation of integral competence; S22 - the formation of general competencies; S23 - the formation of professional competencies); S3 - learning knowledge (S31 - presentation of knowledge in the most targeted form (according to the appropriate learning technology; S32 - accumulation of information about the process of learning knowledge (S321 - knowledge control; S322 - formation of assessments based on knowledge control; S323 - registration of learning outcomes knowledge) ; S33 - learning the process of learning knowledge); S4 - learning skills (actions and operations) (S41 - studying actions and operations; S42 - skills formation; S43 - accumulation of information about the process of learning skills (S431 - monitoring actions and operations; S432 - forming S5 - submission of reference information (S51 - about work with IWSS, S52 - on the implementation of training, S53 - on learning outcomes, S54 - on learning effectiveness, S55 - on learning outcomes) S56 - on the exploitation of the information, technical and software of the IWNS); S6 - preparation of training information (S61 - preparation of the content of virtual learning; S62 - preparation of tasks, simulation experiments, exercises, control questions and tests; S63 - preparation of audiovisual information); S7 - study of learning process (S71 - conducting IWNS exploitation experiments; S72 - testing and monitoring of training technologies; S73 - obtaining data on the effectiveness of technologies and teaching methods; S74 - making decisions about optimal parameters of IVLE, optimal technologies and teaching methods).

3 Conclusions and Perspectives for Further Students

The current direction of increasing the efficiency of learning can be considered the development, implementation and use of IVLE, which would be a specialty of didactics and included virtual reality systems, information, design, interactive, training, gaming and other learning technologies.

The simulation of training in the IVLE determines the implementation of professional, didactic and methodological analysis of the teaching material. Professional analysis consists in detailed analysis and selection of the contents of educational information, didactic - in the choice of one of its forms of presentation, and methodical - in the choice of learning algorithm, the same for all students or individualized, based on the individual capabilities of each student.

The development, implementation, and use of IVLE transforms not only individual actions, but also human activity in general, affecting all mental processes, as there is indirect activity with new sign systems and tools that requires additional psychological efforts from students, and from teachers - the use of new methods and learning methods, and the interconnected and interconnected combination in the learning process of the real and virtual, taking into account psychological and pedagogical factors, allows to ensure efficiency new models of education, which include a proactive character of personality formation.

Therefore, the problems of intellectualization of university virtual learning environments and the creation of virtual universities can determine the prospects for further research.

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