COGNITIVE METHODS IN TECHNOLOGIES OF CREATING COMPUTER GAMES

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***Abstract*—** The use of computer training systems allows individuals to individualize the learning process for each student on the basis of information technology. The purpose of the work is to control the behavior of the student by changing the objective complexity of the teaching material in accordance with the subjective complexity that arises during the training. The task is to develop and theoretical substantiation of the methods of the individualized approach of students for training professional competencies by creating individual trajectories for the seizure and acquisition of knowledge on the basis of information technologies. The method of organizing the learning process with the use of a computer training system, the functioning of which is implemented by a person-oriented student model, is formed. The results of the experimental study proved that due to the adaptation, each student begins to work with the same intellectual load for different categories of students. The structuring of didactic material in the form of a graph with vertices of the corresponding sections of the content, and the management of transitions implements the control system of mastering the material, allows to improve the process of individualization of training.

***Keywords*—** *Individualization of Training; Computer Training System; Person-Oriented Learning*.

1. INTRODUCTION

THE global informatization of comprehensive human activity is the dominant trend in the development of the modern world. In this regard, informatization of education is the most important direction of the implementation of the modern educational paradigm. Application of modern intellectual technologies allows qualitatively changing the didactic process and individualizing the learning process. Moreover, under individualized training, we understand learning based on the individual characteristics of a person, which allows creating the optimal conditions for the best development of the person, the formation of his ability to implement in various fields of activity.

The introduction of modern intelligent information technologies allows a new approach to the problem of individualization of education. The use of computer didactics based on the principles of artificial intelligence allows the implementation of the ideas of personalized learning. In turn, this allows improving the quality of education and promotes the development of professional competencies of the individual. With the use of intelligent information technology, it becomes possible to differentiate educational material according to different parameters. In addition, while defining the characteristics of the student, it is possible to build individual trajectories of learning, taking into account the dynamics and the possibility of changing the trajectory of learning, adapting to its individual characteristics. This allows for the creation of parametric student models that reflect the peculiarities of its cognitive development, in particular, the level of learning and the dynamics of learning. In particular, the created model allows predicting the optimal trajectories of training for a particular individual, modeling various educational situations, which reveals not only the learning process, but also the process of personality development.

Implementation of this approach requires the creation of computer intellectual didactic systems that would allow to predict individual trajectories of learning and to implement, in accordance with them, the educational process. Moreover, individualized learning and a person-oriented approach expand the didactic capabilities of computer learning tools.

2. THE PURPOSE AND TASKS OF THE PUBLICATION

The purpose of the work is to manage student behavior by changing the objective complexity of the teaching material in accordance with the subjective complexity that arises during its study. The purpose of this publication is to develop and theoretical substantiation of the methods of the individualized approach of students to the training of professional competencies by creating individual trajectories for the seizure and acquisition of knowledge on the basis of information technologies.

3. FORMULATION OF THE PROBLEM

In an automated learning system, the object of control is a student who learns certain knowledge. As with any control system, it is possible to highlight two streams of information - direct and inverse. The direct flow of information, or direct influences, brings the learning information of the control object. The reverse flow characterizes the changes that arise at the level of the student's knowledge and is analyzed by the system that teaches them. In this case, there is no doubt that the main way to improve the effectiveness of learning is to improve

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direct influences. This is due to the fact that due to only direct influences the learning process takes place.

4. BRAIN MODEL

One way to manage a learner's activity while learning a course material is to change the level of accessibility of the content provided by the student. This is because the same content can be described with different levels of accessibility, which causes a different level of difficulty when it is studied by the student. At the present stage of the development of information technologies, it is practically impossible to synthesize arbitrary text with the given accessibility of presentation. It is also impossible to do this synthesis during real-time learning. Thus, preliminary development of educational content is required, which is differentiated by complexity.

The question of analyzing the complexity of various educational material and the possibility of its differentiation by complexity is partially considered in the work of Sokhor A.M. [1], in which the author considers the features of the definition of the logical structure of the educational material. In this case, the complexity of the educational material is measured by some objective characteristics. However, during an individual work on content, there are complexities of assimilation, which are completely dependent on the subject. Subjective difficulty mastering information while working on the content, perhaps measured by indicators such as the number of errors that made the students while performing tests of control and rate [2.3].

In this case, the object of control is the student, and the controlled process is the process of mastering the knowledge of this student. At the initial moment of study, the course of the assimilation process of the initial material is usually not defined. Characteristics of this process cannot be pre-determined experimentally. Thus the ability to control objects with a high degree of uncertainty based on the initial use of adaptation when the initial uncertainty is reduced through the use of the information obtained in the learning process.

However, in educational systems, adaptation cannot be fully exploited. This is hindered by the following. First, the feedback information does not allow to effectively evaluate the student's mental processes during training. It is only possible with a certain probability to estimate how the acquired knowledge is acquired. Secondly, even evaluating the process of assimilation is sufficiently reliably impossible to effectively influence its changes because the system of managing influences was created in advance without taking into account the individual characteristics of the student.

These restrictions are valid for learning knowledge and lose meaning when learning skills [4].

5. DEVELOPMENT OF THE DIDACTIC SYSTEM

In Fig. 1 shows the structure of the educational system that implements these principles [5]. Some training object is present in the source of educational information in the form of a plurality of portions of the material, which comprise the text and control questions. The figure depicts the interaction of blocks and shaded concepts that are covered by control issues. According to the results of work on the previous doses of content determined by some i – the level of objective complexity of the material. The student is provided with a portion that includes the text Ti and the set of control questions {Ki}. The Answering Block analyzes student responses.

The assessment of responses is based on the principle of determining the percentage of correct answers or not. And with the help of the block of determination of the pace of work, comparing the work time with the teaching material with the permissible time norm. The results of this comparison also make a decision whether or not. Information from these blocks comes to memory, where information about the results of the performance of the last three control tasks is stored. It allows you to evaluate the subjective difficulties that cause the content over which the student works. According to the results of analysis and in accordance with the learning algorithm, the level of complexity of the new material is selected.

The proposed method for constructing the didactic system of person-oriented learning was implemented and passed an experimental test [5]. During the experiment, an educational program with three levels of difficulty, as well as various means of correction of errors [6] was studied. There were two ways to correct errors. In the first method, the student himself found the reason for the false answer, studying the same material, but in a more detailed presentation. Another way was to get the student a full explanation of what the correct answer should be. Figure 2 shows the change in the average work time over the dose of the training material (dependence of 1,2) and the percentage of correct answers to the control questions of one dose of the material (dependence of 3.4) for the group of students. Dependencies 2, 4 correspond to the second method of correction of errors, depending on 1, 3 - the first. According to the results of the analysis of the above graphic materials, one can conclude that the second way of correction of errors, unlike the first, reduces the student's activity to the end of work on content. This is due to reduced working time on one dose of material and an increased number of errors.

The results of the experiment proved that adapting to the individual characteristics of the student led to the fact that each of them began to work on accessible material. There was no significant difference in time in this case, which could be interpreted as roughly the same intellectual load. for different categories of students. At the same time, the clear structuring of the didactic material in the form of a graph in which the vertices correspond to the sections of the material, and transition management is implemented using a test system for assimilating the material of the unit, which allows for the full implementation of personalized learning.

Implementation of the developed approach clearly demonstrates the process of the motivation of students during training with the use of computer gaming technologies. So the availability of multiple levels of difficulty allows people with different skills to participate in the game and move to higher levels after sufficient practice and become an expert. Granting access at different difficulty levels means that not all students are on the same trajectory. Playing at the most appropriate level of difficulty not only helps the player interested in playing, but also in terms of experience, preparing for the transition to the next, higher level of difficulty. The requirements of the game vary from one moment to the next, from the situation to the

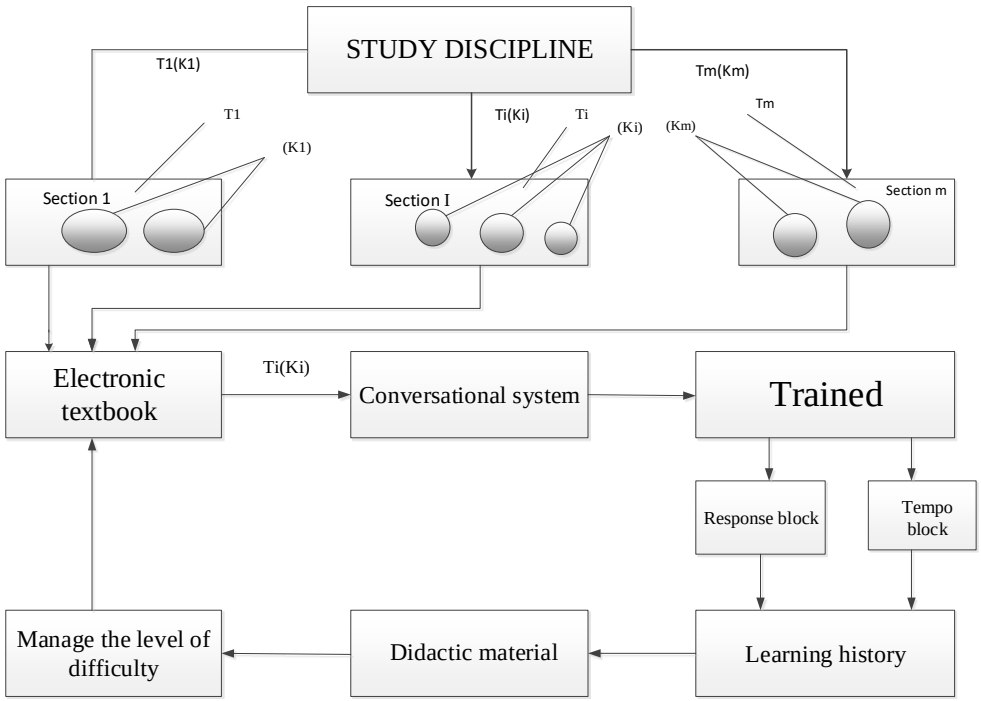

Figure1 - The structure of the didactic system of person-oriented learning

situation. This creates a problem in assessing which cognitive functions have been active and for how long.

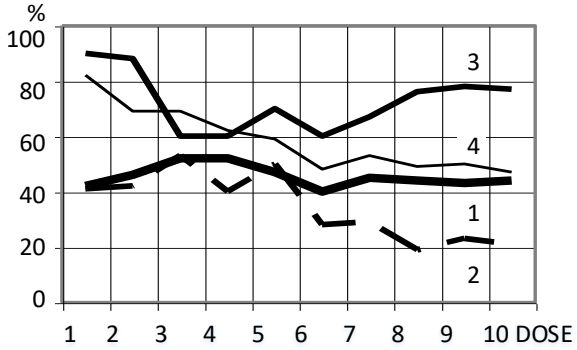

Figure 2 – Average working time on the dose and percentage of correct answers: 1 - time with correction of errors in a 1st way; 2 - time with correction of errors in a 2nd way; 3 –a percentage of correct answers with correction of errors in a first way; 4 – a percentage of correct answers with correction of errors in the second method.

The development of computer gaming technologies has shown that the main way to improve the effectiveness of training is to improve the direct effects channels, in particular, the use of the 3-dimensional visualized environment. This is due to the fact that the human perception system was developed in a three-dimensional space. Therefore, the initial sensory processing of the visual environment is carried out with a reflection of what we see in the real environment. Considering that several visual events may occur practically simultaneously in different places of gambling space, the main priority of the player is to quickly locate, identify and assess the level of potential threats to the player. To do this, an effective scanning of the visual space should be performed.

Computer gaming environments are very complex. The complexity of the task depends on the content and such fundamental features as spatial selective attention, memory and other sensory and perceptual abilities. It requires, besides basic operations, additional cognitive processes, such as search, comparison,a symbolic solution to a problem.

Usually, players take part in several simultaneous events. Many cognitive and motor skills are involved. Simultaneous tracking of multiple objects, visiting multiple places in the gambling space or solving more than two tasks simultaneously requires the allocation of attention. In turn, the allocation of attention reduces the speed and correctness of the decisions taken by the player. This imposes restrictions on the number of objects, their location and the number of tasks that need to be solved simultaneously. Normally, a person can not simultaneously hold more than 4 elements in the RAM and visit more than 4 objects at a time. Memory allows you to store, maintain and subsequently remove information. Distinguish operative and long-term memory. RAM stores information for current manipulation and is closely related to the system of attention. Instead, long-term memory gets information through the learning process and vice versa. RAM gets information from a long-term storage site in accordance with the requirements of the current task and under the control of executive processes in the human brain. In this way, operational and long-term memory complement each other. The inability to efficiently

store and process information in the RAM leads to low performance in solving many problems.
The spatial focus execution processes track the contents of the RAM and coordinate other brain systems that are needed to service and select features of the objects.
Effective work of spatial selective attention and memory is important for solving complex spatial problems.
In addition to focusing attention, there is often a need to switch attention from one location to an object or a task to another. Such switching also involves the cost of processing information as it takes some time to unlock and re-launch. The quick switching of attention from the current task to the new requires additional time losses, especially for beginners.
On the other hand, the proliferation of attention on a wide field of view allows you to see the peripheral world without concentrating attention on most objects of the periphery. However, the visual system can not handle all the information. Most of the raw visual information is not important for the purpose of the game and can be ignored.
At the same time, in order to attract attention and reduce the processing time of the information, the visual system should be sensitive to changing the position of the object, brightness, and color. Attention is directed directly to the place where the sudden change occurred, which is associated with a sudden start or a change that attracts attention. Sudden events are quickly analyzed by the brain, using processes that require identification, recognition, and decision making. Usually, processes pass through the eyes and moves. The next step is to recognize the object that attracted attention by rejecting information that is not related to the object. This is visual selective attention. Gram practice improves the ability of spatial selective attention. Thus, improving this basic skill increases the productivity of other tasks by maintaining functions that depend on this ability.

6. CONCLUSIONS

New methods of cognitive learning, based on video games, help develop, preserve and improve spatial cognition. All tasks in spatial cognition are supported by attention and level of RAM, which are closely interconnected. Complex spatial tasks require quick removal, decoupling and redistribution of attention for the multitude of features of the object. At the same time during several stages of processing information should selectively switch the attention between the qualities of the object in the memory to support their activity.
The method of organizing the learning process with the use of a computer training system, the functioning of which is implemented by a person-oriented student model, is formed. The results of the experimental study proved that due to the adaptation, each student begins to work with the same intellectual load for different categories of students. The structuring of the didactic material in the form of a graph whose vertices are the corresponding sections of the content, and the transition management implements the control system for mastering the material, enables to improve the process of individualization of education
The large amount of information that requires processing in spatial cognition provides the opportunity to use visual information to control the motor system while performing tasks. It is determined that visual coordinate coordination is the main skill for implementing an adequate reaction to changing the external environment in computer games.
Thus, the cognitive techniques used in the development of computer games can revolutionize the teaching of spatial skills and concepts. In turn, this will have significant social and economic implications in the field of basic education.
Further research should also be directed in the direction of identifying the regularities of the process of learning knowledge through learning by controlling the student's attention with the use of neural interfaces.

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BIOGRAPHIES

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