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Creating an Electronic Textbook in a Programming Environment

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Abstract: The article discusses modern information technologies in their development have reached the point where they have become available for development and use in everyday work to almost anyone - from a schoolboy to a professional. One of the easiest to learn is the technology of building hypertexts. The simplicity of the hypertext concept also determines the formal simplicity of the generally accepted hypertext creation technology. Having a simple hypertext construction system, you can quickly assemble hypertext from one or several text files and get an electronic version of the text.

Keywords: concrete, reinforced concrete products, formless formation, wire, rope, hollow core slabs, production efficiency analysis, equipment, production line.

Modern education policy, as well as certain socio-economic conditions have created a situation where a large number of low-quality educational literature, including electronic textbooks, appeared on the market. Almost all electronic textbooks are built on hypertext technology. Hypertext has a certain semantic network structure. With numerous views, if hypertext is used as a textbook, this structure will greatly affect the structure of the user's knowledge on this issue.

This fact cannot but affect the quality of textbooks created in electronic form, most of which are reduced to an electronic (machine-readable) copy of the paper version of the document with an elementary arrangement of hyperlinks. However, in this case, the following point falls out of attention: a textbook cannot replace a teacher who presents the material in a certain sequence, conducting intermediate control and a lot of practical tasks, offering exercises not only on the topic being studied, but also tasks of increased complexity designed for "advanced" students. For this reason, the author has set himself the task of developing a more advanced, scientifically based technology for creating electronic textbooks, in which the developer would have more opportunities to manage the internal semantic structure, more opportunities to influence the quality of the resulting systems. In addition, knowledge of the technology of creating electronic textbooks will help to reduce time costs and optimize the efforts of the team of developers of this type of software products. Knowledge of the aspects of legal protection of electronic textbooks will help to avoid copyright violations of developers.

To date, there is an active process of creating training programs in hypertext form and their active dissemination, as well as attempts to introduce them into the educational process. However, there is no single standard for the construction of electronic textbooks, there are no mechanisms for their legal protection, there are no uniform criteria by which the quality of electronic textbooks is determined. And this, in turn, generates a great variety of low-quality software products, where each author tends the design line of creating a program in his own direction. In addition, the fact that the process of creating hyperlinks is often a disordered process leaves its mark, which means that it is very easy to get confused in the logic of hyperlink transitions. As a result, there are a lot of programs that are very difficult to understand. The novelty of the research will consist in the development of recommendations for the construction of the hypertext of an electronic textbook and the internal organization of its structure.

The purpose of this work is to create principles for the construction of electronic textbooks, to develop practical recommendations for the creation of a scientifically based structure of an electronic textbook, which is one of the most common information systems.

8 Tasks In the course of work, the following tasks are solved:

1. Research of general technologies used in practice for the construction of electronic textbooks. Practical development of promising technologies and formulation of a system of ideas, models, technological steps, and educational tools.
2. Development of a standard technological scheme for the creation of an electronic textbook.

Creation of specific electronic textbooks for the purpose of debugging on specific examples of the correctness of the proposed solutions.

Bringing the proposed model in line with modern achievements (both in the field of educational activities and in the field of psychology of learning, placement and presentation format of various forms of information, software development), as well as with standards.

Theoretical significance

Scientifically based principles have been created for the construction of information systems important for the processes of education and training - electronic textbooks using modern technologies, achievements in the psychology of learning and standards of educational activity.

Practical significance

The results of this work will be recommendations for the creation of electronic textbooks. They will help developers of electronic textbooks in the design of their software products to increase the efficiency of their work, and will also contribute to the introduction of high-quality electronic textbooks in their active use.

An electronic textbook is a special case of an electronic book and a software product

Let's define an electronic textbook. An electronic textbook is a software and information system consisting of computer programs that implement scenarios of educational activities, and knowledge prepared in a certain way (structured information and a system of exercises for its comprehension and consolidation) that meets all the requirements for both educational literature and software products.

Article 4 of the UZR Law "On Copyright and Related Rights" states that a computer program is "an objective form of representation of a set of data and commands intended for the

operation of computers and other computer devices in order to obtain a certain result, including the preparatory results obtained during the development of a computer program and the audiovisual displays generated by it".

It is to computer programs that the electronic textbook belongs, since its main goal is to solve the problem of bringing the material to the learner.

There have already been separate attempts to classify training systems according to various criteria, but there is no unified classification of electronic training systems now. This problem was widely discussed on the electronic forum [4]. For example, the following classification can be found in the literature.

Electronic textbook - like a traditional textbook, it contains theoretical material on a specific subject and examples (for example, examples of problem solving).

The control system is designed to control knowledge through tests. In addition to testing mechanisms, it may include means of statistical processing of results.

A learning system is a human-machine complex operating in an interactive mode and designed to manage cognitive activity. As the name suggests, it should teach, and only the study of theoretical material is not yet training. Therefore, a learning system is a broader concept than an electronic textbook. It should include theoretical material with examples (i.e. electronic textbook), as well as means for developing practical skills in trainees and means of controlling acquired knowledge, skills and abilities (a monitoring system and a training program).

The main purpose of training (and, consequently, of the training system) is to master skills, not knowledge. The mechanism of activity is the solution of tasks [4]. Therefore, the main part of the training system is the training system.

An intelligent (adaptive) learning system is a learning system with elements of artificial intelligence. Such a training system allows not only to train the learner and control his knowledge, but also, based on the results of the learner's activity, it can determine which knowledge is insufficient or erroneous, and return the learner to the appropriate section of theory or practice, or give additional explanations. I.e., it allows you to adapt the learning process to the characteristics of each individual learner working with the system [5].

A distance learning system is a learning system that supports remote work over a network. Thus, the teacher and the student are separated in space and time: the student is engaged on his computer, and the teacher controls his activities on his own. The training material, tests, tasks and training results are stored on the network server.

However, when implementing a distance learning system, the following problems arise [54,60]: lack of real access for the mass user; poor communication quality, low speed and unreliability of communication, especially on old PBX; disbelief and ignorance of the possibilities of the world Wide Web.

Hypermedia learning system is a learning system based on the use of hypertext to present theoretical material. The use of hypertext allows you to combine various ways of presenting information (text, images, sound, video, etc.), easily link various materials together. However, the trainee, following the links from one document to another, can easily "get lost" and forget where he came from and where he started training. This phenomenon is called the "loss in hyperspace" effect [10]. To avoid this effect, methods are used to return the learner to the starting point of training. We will consider such systems to be imperfect and require a clear algorithm for constructing hyperlinks.

A training course is an even broader concept than a training system. If the training system is designed for a specific subject area, then the training course may include several training systems in various subjects (which, in particular, may be interconnected), and the student can study any of the proposed subjects (which specific subjects he chooses to study himself or the teacher does it). Training courses can be adaptive, distance, and hypermedia.

Based on the above, we agree that the most convenient and accessible for most computer users in the development of electronic textbooks is hypertext technology.

Since we have decided that an electronic textbook falls under the definition of "computer programs", we will consider the issues of copyright protection for this type of computer programs.

Requirements for textbooks

Any teaching methodology, including the use of information and communication technologies for educational purposes, must comply with the general didactic principles of teaching. The analysis of foreign and domestic studies, as well as the practice of using PS, allows us to conclude that one of the main reasons for the creation of low-quality PS is precisely "partial, and sometimes complete disregard of didactic principles of teaching in their development" [9, p. 8.]. Based on the works [8; 9; 6; 7; 9; 5] let us consider the main didactic requirements for the PS HE.

The requirement to ensure the scientific content of the PS, HE assumes the presentation of scientifically reliable information by means of the program (if possible, by the methods of the studied science). The process of assimilation of educational material with the help of PS, IT should be built in accordance with modern methods of scientific cognition: experiment, comparison, observation, abstraction, generalization, concretization, analogy, induction and deduction, analysis and synthesis, modeling method, including mathematical, as well as the method of system analysis.

The requirement of accessibility means that the educational material presented by the software, the forms and methods of organizing educational activities must correspond to the level of training of trainees and their age characteristics. Is the educational material presented with the help of the HE PS available to the student, does it correspond to previously acquired knowledge, skills and abilities.

The requirement of adaptability (adaptability of the PS HE to the individual capabilities of the learner) involves the implementation of an individual approach to the learner, taking into account the individual possibilities of perception of the proposed educational material.

The requirement of systematicity and consistency of training using the HE PS, its connection with practice. It is necessary that knowledge, skills and abilities are formed in a certain system, in a strictly logical order and find application in life. To do this, you need: 1. Present the material in a systematic and structured form. 2. Taking into account both the retrospective and the prospects of the formed knowledge, skills and abilities in the organization of each portion of educational information. 3. Taking into account the intersubject connections of the studied material in the PS HE. 4. Careful thoughtfulness of the sequence of presentation of the material and teaching influences in the PS HE, reasonableness of each step in relation to the student. 5. The construction of acquired knowledge in a sequence determined by the logic of learning. 6. Ensuring the connection of the information presented by the PS ON with the practice by: a) linking with the student's personal experience; b) selection of examples; c) creation of meaningful game moments; d) presentation of practical tasks, experiments, models of real processes and phenomena. The requirement to ensure the consciousness of learning, independence and activation of the student's activity involves providing the means

of the program for independent actions of students to extract educational information with a clear understanding of the final goals and objectives of educational activities.

The content that the student's educational activity is aimed at is truly conscious for the student. It should be based on an operational approach. Therefore, a clear model of the student's activity should be traced in the PS HE and the motives of his activity should be adequate to the content of the educational material.

The requirement to implement the capabilities of computer visualization of educational information presented by PS ON. It involves an analysis of the capabilities of modern information display media (these are the technical capabilities of information display media, for example, computers, multimedia projectors, virtual reality tools and the capabilities of modern software) in comparison with the quality of presentation of educational information in the ON PS.

The requirement to provide an interactive dialogue and suggestive (from the English suggest - suggest, advise) feedback presupposes the presence of a convenient dialog in the mode of dialog communication and the possibility of organizing it at the request of the user. An important part of the organization of the dialog is the reaction of the program to the user's action. Suggestive feedback monitors and corrects the actions of the student, gives recommendations for further work, provides constant access to reference and explanatory information. When monitoring with error diagnosis based on the results of educational work, suggestive feedback provides an analysis of the work with recommendations for improving the level of knowledge.

The requirement for the development of the intellectual potential of the trainee involves: the formation of thinking (for example, algorithmic style of thinking, visual-figurative, theoretical); the formation of the ability to make optimal decisions or variable decisions in a difficult situation; the formation of information processing skills (for example, based on the use of data processing systems, information search engines, databases).

Methodological requirements are closely related to the didactic requirements for the PS HE. The methodological requirements for the PS ON suggest the need to: take into account the peculiarity of the specifics of a particular subject: to provide for the specifics of the relevant science, its conceptual apparatus, the specifics of the methods of studying its laws; the implementation of modern methods of information processing.

On the basis of the didactic requirements for the ON PS, it is possible to list the most significant methodological goals, the implementation of which justifies the introduction of new ON PS into training:

International standards in the field of technologies of educational information systems

All over the world, work is underway to standardize training technologies. There are a number of international organizations working in the field of standardization, consortia and national programs, ministries of individual countries that closely cooperate in the development of elements of a systematic approach to the construction of distance learning systems or any other training systems operating on the basis of information technology.

Among these organizations, the leading role belongs to the IEEE-accredited LTSC Committee P1484 for Standardization of Training Technologies (Institute of Electrical and Electronic Engineers, Project 1484, Learning Technology Standards Committee); the European Union project ARIADNE (Alliance of Remote Instructional Authoring and Distribution Networks for Europe), which aims to develop tools and methodologies for production, management and multiple use of pedagogical elements developed on the basis of

computer technologies; the American IMS (Educom s Instructional Management Systems) project, which develops technological specifications for the development of the education market; the organization of the American Department of Defense ADL (Department of Defense Advanced Distributed Learning), which determines the requirements for training technologies. There are other organizations that are more or less involved in the development of standards and specifications for training systems based on information technology.

It should be noted that all developed standards and specifications are neutral in terms of pedagogy, content and implementation platform.

Computer training materials are mainly developed for the private purposes of a particular organization, which as a result leads to a high cost of their development and limited value for commercial distribution. Only American companies spend billions of dollars a year, with a small amount of investment, on the development of educational products aimed at selling on the market, or customized products. By defining development directions, projects for the development of standards and specifications for educational information systems seek to create new markets for educational materials, reduce the cost of development and increase the potential return on investment.

A review of trends in the development of the software industry shows that many companies currently consider an object-oriented approach to be the basis for ensuring platform neutrality and the possibility of using software in the conditions necessary for the large-scale development and distribution of powerful and cost-effective educational content. Platform neutrality and the ability to use software in such conditions are considered necessary for the sustainable investments required to create various types of dynamic learning environments (such as ADL, IMS, ARIADNE) that are needed to meet the educational and retraining needs of the twenty-first century.

Project participants share the view that the specifications for new platform-independent methods are mature enough to justify investing in next-generation applications. However, it is obvious that more innovations are needed in the field of training and retraining, and that the development of reliable object-oriented and platform-neutral environments for distributed learning will become feasible and feasible in the next two to five years. Therefore, the analysis and design of such environments are relevant right now in order to prepare the basis for applied developments in this area in two years.

The mission of the IEEE LTSC Standard Working Groups is to develop technical standards, recommended practices and guidelines on software components, tools, technologies, methods and developments that facilitate the development, deployment, maintenance and interaction of computer implementations of educational components and systems. Content standards are out of consideration. The Committee for Standardization of Educational Technologies (LTSC) was delegated authority by the IEEE Computer Community Council for Standardization Activities (IEEE Computer Society Standardization Council). Many of the standards developed by LTSC will be put forward as candidates for international standards for consideration by the ISCMEC/JTC1/SC36 Committee (International Organization for Standardization/International Electrotechnical Committee I Joint Technology Committee 1, Information Technology/Learning Technologies).In November 1997, the Department of Defense and the White House Office of Science and Technology Policy launched the Advanced Distributed Learning (ADL) initiative. The main partner in ADL was the Instructional Management Systems (IMS) project, a consortium comprising government organizations, over 1,600 colleges and universities, and 150 corporations. The aim of the IMS project is to develop an open architecture for online learning. While other activities of ADL are related to the development of the content of training courses and the delivery of training

materials using modern and developing technologies, the IMS project focuses on the next generation open architecture for online learning. Other participants in the launch of the new project were representatives of government and industry, such as Apple, General Motors and Microsoft.

The goal of the ADL initiative is to provide access to high-quality educational materials that can be tailored to the individual needs of the student and can be made accessible,

The principle of the impossibility of the existence of a universal shell for the development of electronic textbooks

It is impossible to unify subject areas, it is impossible to develop a single template for EC of different orientation.

Some sciences (physics, astronomy, chemistry) require the use of graphic materials: illustrations, graphs. Other sciences operate with formulas, SD models (mathematics, chemistry). Still others are limited to a verbal description of the subject area (philosophy, languages). It is not possible to unify the order of arrangement of graphic materials, text, formulas. However, this order is important from the point of view of presenting the material to the student. 2. The development of EC requires the coordinated work of various specialists: a subject teacher, a programmer, a designer, a psychologist, a tester. In this way, the development of an EC can be compared with the development of an expert system. One person is practically unable to combine the qualities of an excellent subject teacher, a good programmer, and a psychologist. In addition, like any other computer program, the EC requires beta testing in order to identify weaknesses of the program, incorrectly working modules, difficulties in working with the program. 3. Ready-made shells impose ready-made EC solutions, thereby limiting the developer in terms of the design of the EC. As a consequence: the monotony of the EC, the limited means of execution of the EC, and sometimes the need to study the development environment of the EC.

The monotony of educational software can lead to the fact that students may find the process of working with EC tedious.

The limitation in the means of execution of the EC generates the so-called containment of the creative potential of the developer of the PP. Often the expressiveness of the means of execution of PP means a lot (example: working with Windows XP).

The need to study the EC development environment slows down the process of creating 1111, since it takes some time. Studying all the subtleties of software environments sometimes takes months, and sometimes years. At the same time, a programmer using a universal development tool, which is any high-level programming language, will be able to create a good EC in much less time. 4. Ready-made shells will not allow another person to maintain the system in the future. If the program is written in a high-level programming language (Inprise Delphi, Visual Basic), if necessary, any programmer who knows this language will be able to make the necessary changes. There is no universal shell for electronic textbooks (and there cannot be), therefore, all ECS executed in some shell are written in the HTML (XML) standard, or in the developer's own format, which negates the portability and the possibility of updating the EC. The use of the XML standard will not allow the developer to solve the problem of confidentiality of data for testing trainees.

Conclusions: To date, several shells are known for creating an EC, for example, the eLearning Office 3000 of the Hypermetod company, extensible Distance Learning System. At the same time, there are many small author's programs designed to create EUs (SunRav BookOffice, Markiz, Toolbook Instructor I Assistant, Macromedia Authorware, Quest, etc.). You can get acquainted with them on Internet sites with free software [7,5].

The use of a format designed specifically for a specific EC is also inefficient because such an EC is like a static database: its place is reserved for each record, but if any field remains blank, it still occupies a certain place on the computer disk. From this point of view, the use of programming languages allows us to solve this problem. At the same time, the question arises about the format of data storage. For the above reason, using the DBF format will not be appropriate. When using the C++ programming language, it is possible to create a so-called dynamic databases - DLL files. The use of dll files as a database for storing information (for example, about the users of the system, the results of their testing) allows you to solve the problem of "empty" fields, as well as the issue of data confidentiality.

When developing a system for the protection of electronic textbooks, first of all, it should be borne in mind that the EC is a computer program, which means that it affects copyright issues.

Software protection tools will be divided into 2 classes: external protection tools and internal protection tools. External protection means include protection against unauthorized copying, the use of foreign keys, password protection for entry, the use of demo versions of the program with a temporary restriction of use. Internal protection means include password protection for entering individual modules of the program, restrictions on access to the results of the program, incomplete implementation of the demo version of the program, "foolproof" protection.

The complex application of computer program protection tools is one of the most reliable ways to ensure the information security of a computer program.

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