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Modeling of formation of electronic materials adaptive learning course

Methodology: Analytical review of approaches to the formation of e-learning courses, methods of building models of relationships student-learning system and methods of adapting teaching materials in accordance with the characteristics of students. Findings: The model of the electronic learning complex is constructed and the principles of constructing its individual component modules are considered in detail. The results of the research were used in the construction of on-line courses for distance education. Originality: the model of the electronic learning system has been modified with the possibility of adapting all elements of the system. Practical value: the presented model can be used in electronic learning systems.

Introduction

The modern approach to the formation of electronic learning systems (ELS) has long gone beyond the duplication of the content of textbooks in networks (Internet or corporate networks of educational institutions). Modern ELS provides for their use in the full cycle of education, as global systems or separate subsystems supporting the educational process. ELS can be involved in all stages of the educational process - the formation of curriculum and learning process management organization (systems and control pan innya Training) training materials to form courses of knowledge control and driving exam information (systems and control pan and n ing educational content).

The main advantages of the owl using The ELS is an opportunity to individualize the educational process by taking into account a wide range of individual characteristics of students and the adaptation of learning trajectories [1, 2]. A realization le indiv Izov tion ELS approach involves constructing a model of the educational process that should you model includes an educational environment (intelligent interface), educational materials, learning control system, the system user (student) [3].

Formulation of the problem

In an individualized approach to the development of the ELS, it is necessary to formalize the parameters for adapting the ESN to the student. Well-known approaches to individualized educational material forming Incl uyut inresponse and (errors, types, categories, sequences), level of depth (connection with other topics, mistakes in a multi-choice choice, etc.) [2], individual idiosyncrasies (basic level, interests, psychological and physiological peculiarities, etc.) [3], situational factors (forming links "error - educational effect") [4].

I question formation of learning materials s consideration ayetsya in various standard s, spread and in developing electronic educational media (eg, Nab and SCORM standards, the board yaye section "Model mix of materials» (Content Aggregation Model), which organizes a set of metadata for describing objects rate [5]).

However, standard meta data enough for high-quality automatic creation or adaptation course [6], as introduced additional parameters that describe the roll b

each object in the structure of course [7] connections between subjects [8], orderly of topics, and others, that are not provided standard SCORM.

The solution of the problem of formation of adaptive educational materials electronic courses should be conducted through a combination of models of the formation and presentation of educational materials and information on knowledge, containing in these materials. In full, the question of the adequacy of the parameters in describing the systems for the formation of electronic materials of training courses is not resolved, but has some solutions that are implemented in operating systems.

Mathematical model of electronic learning system

The system of formation of educational materials goes to the general model of adaptive learning system, which combines user models, electronic learning system (containing a model of learning resources) and adaptation systems. Each of the elements of this model is represented by a group of parameters, which must fully characterize the object for the possibility of modeling the system and forecasting its effectiveness [7].

In general, the user can be represented as follows:

$$U = \{OP, SP\},$$

where $OP = \{op_1, op_2, ..., op_m\}$, $SP = \{sp_1, sp_2, ..., sp_{n}\}$,

where OP - set objective parameters, SP - plural subjective parameters.

Electronic educational system can be represented ma two sets of parameters:

1) interface parameters (include the parameters of the learning resources);

2) functional parameters:

$$ESE = \{IP, FP\},$$

where is $IP = \{ip_1, ip_2, ..., ip_k\}$, $FP = \{fp_1, fp_2, ..., fp_l\}$,

where is IP – set of interface parameters, FP – set of functional parameters.

In general form process adaptation educational systems is reduced to a set the rules with modifications Each the component the interface educational systems for each user. For representation processes modifications educational systems take advantage of the next formula:

$$PA = \{pa_1, pa_2, ..., pa_o\},$$

where PA is the rule for modifying the parameters of the system in accordance with the user parameters ($o = (m + n)(k + l)$).

The possible representation of educational objects is described in [8], where it is presented approach to formation educational materials in the form of three scenarios (levels) of disclosure of content, which are presented in the form of interconnected educational objects: chapters, sections, divisions, paragraphs, drawings, formulas, and others.

Development of a system of restrictions on materials of electronic training courses

To describe the process of construction, binding and order of materials courses make use of graph theory by which the educational process can be represented as a series of transitions that do not violate logical ordering of the material for hypergraph vertices that represent learning objects [9, 10, 11].

Teaching mothers or courses are represented by a hypergraph O (V, E_0), where each hyperdoughe is from the set $E_0 = \{(A, B)|A, B \in 2^V, A \cap B = \emptyset\}$ given a pair of sets such that elements of the B immediately following the elements of A. For each stage of learning, a set is formed V_{st} - the set of objects that are already studied, and V_{fin} - a set of objects to be studied. In order for the presentation of the material to not have logical ruptures, it is necessary to select the following educational facilities that meet the criteria:

$$c \notin V_{st}, \exists(A,B) \in E_0 : c \notin A, c \in B, A \cap V_{st} = \emptyset.$$

Additional a condition that limits plural of objects that can be provided the user only those approaching him study the objects with V_{fin} or belong to plural $V_{fin.}$:

$$\exists(C, D) : c \in C, D \cap V_{fin} = \emptyset.$$

These rules allowed to make an automatic check in the formation of a hypergraph of study materials discipline, which reduced the burden on the operator and requirements for his qualifications during the work of forming a training course on the online resource.

Conclusions

Adaptive ELS is just one of the existing varieties of adaptive systems, so hybrid replacement tools and implementation methods that already exist in adaptive web and mobile systems are allowed. Increased attention and the amount of ELS require more attention to the logic and sequencing of teaching materials, their decomposition and presentation format.

Existing adaptation tools in e-learning systems with elements of personalization can be divided into two main groups: 1) informing, which serve to personalize information; 2) filtering tools that help the user to find relevant blocks of information for educational adaptive systems.

The task of training resources for electronic adaptive learning systems requires not only an analysis of approaches to the formation of an adaptive intelligent interface model, as well as the location of learning resources in this model.

On the basis of the constructed model, a more detailed analysis of the possibility of three-level formation of the electronic materials of the ELS with a module for automatic determination of logic of the sequence of presentation of materials was conducted.

This approach only reveals one of the capabilities of the training resources and does not include an analysis of adaptation processes that are oriented on users with different levels training for work with computer, different basic knowledge by subject matter learning different mental, psychological and physiological opportunities.

Also, this approach is considered separately from the assessment of the level of knowledge gained, which is the reason for the continuation of scientific research and a more detailed analysis of the following parameters of the model of the adaptive learning system:

1) knowledge by user themes;

2) goal or task user

3) preparation and experience user
4) preference;
5) interests;
6) individual features user

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