REVISTA ESPACIOS

Principles of design of electronic educational resources

Principios de diseño de recursos educativos electrónicos

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Contents

ABSTRACT:

The article describes a generic approach to the design of the content of electronic educational resources (EER) based on the formation of a unified methodology of teaching special disciplines, with the broad use of modern information technology.
Keywords: Electronic educational resources, designing e-learning resources, content formation, visualization of the content objects

RESUMEN:

El artículo describe un enfoque genérico para el diseño del contenido de recursos educativos electrónicos (EER) basado en la formación de una metodología unificada de enseñanza de disciplinas especiales, con el amplio uso de la tecnología de la información moderna.
Palabras clave: Recursos educativos electrónicos, diseño de recursos de e-learning, formación de contenido, visualización de los objetos de contenido

1. Introduction

Currently, there are many techniques for developing e-learning resources (ESM), which as a rule contain General guidelines for building the structure of the e-course, i.e., are Advisory in nature. "Information and communication technologies in education. Terms and definitions" introduces a definition of the ESM: "The electronic educational resource means an educational resource, represented in digital form and which includes structure, subject content, and metadata about them, as well as data, information, software, necessary for its use in the educational process". In the Guest there are the following types of training: electronics, mobile, network, independent, mixed, joint. Additionally the concept of "educational content", which refers to a structured subject content used in the educational process. In e-learning educational content is the basis of electronic educational resources (Zainutdinova, 1999).

Electronic learning resources of various kinds, completeness and applicability in the educational process can take the following forms (from the experience of development and

implementation in universities of Kazakhstan):

1. lecture notes;
2. teaching aid;
3. a guide for laboratory practical work;
4. a tutorial on the cycle of practical seminars;
5. presentations (slide-lectures, lectures and practical presentations, etc.);
6. methodological support and materials for independent work;
7. organizational-methodical instructions on studying of discipline (usually duplicated in paper form);
8. test materials, test questions etc. (Development tool for distance learning courses. (2016). http://www.ict.edu.ru/).

The combination of all these materials and their implementation in the same style can be converted to electronic educational-methodical complex.

Some experience in creating e-learning resources is reflected in the works of L. H. Zainutdinova [1] A. V. Solovova [2], A. V. Aspen [3], I. P. Norenkov [4], V. V. Gura [5] etc.

1.1. Unsolved research problems

In this case, the main components of the created resource modules are relatively independent parts of the educational information, which may be implemented as a self-test and the pedagogical test of knowledge. A page is considered a logically independent part of the manuals included with the module, which consists of media resources, deploying training material in a logical sequence intended by the author - designer of the ESM. Media resource here is the minimal unit of educational information of different modalities: text, video, picture, sound, test, Hyper link, which is a unit of media text. The content model of the ESM proposed by other authors [2] constructed in this way.

These peculiarities of the subjects of the cycle of special disciplines (SD) have a significant impact on the formation of educational content, which is analyzed and is determined at the creation of electronic educational resources (Gura,2007).

Consider the basic process of the development of the ESM. Since the electronic educational resource is an information system, respectively its life cycle is the life cycle of

the information system, which is a continuous process, starting from the moment of making decision on creation of information system and ending at the time when its withdrawal from service (in this case from the learning process) (Zainutdinova, 1999).

Table 1
Examples of different media and tools for various pedagogical
tasks in the creation of electronic educational resources.

Educational task	The media and tools
Navigation	Buttons, links, animations, maps pages, table of contents, navigation tree, search, help
The clarification, document, observation	Text (explanation, detail, guidance on the use, the comment text, tooltip)
The show models, examples, presentations	Photos (new camera) Diagram (it depends on the quality of the image from the selected resolution when shooting) Screenshot (how to transfer photos to the computer) Circuit (diagram of the parts of the camera) process Model (block diagram)
Demonstration of qualitative and quantitative relations	The concept map (Visual map of the distribution of the distance learning system MOODLE in the world) Diagram (structure of the institution) Graph (correlation between stress and life

	expectancy)
Show changes over time	Animation (change of clouds before a storm) Applet (effect of standard deviation on shape of normal curve distribution) Video (display of the electronic shutter of the camera) Simulation (how alcohol affects reaction time)
Show hidden concepts (difficult in a simple explanation, abstract)	Graphic analogies (how to calculate compound interest) Animation (how blood flows into the heart and out of it)
Video practical work	Simulation (adding and dropping a paragraph of text in the document)

Note: compiled by the author according to the results of the study (Karbozova, 2017)

The specifics of development of e-learning resources at the stage of completion of the cycle is the testing, introduction in the educational process, evaluation of its effectiveness and consequent adjustments, as well as the review and registration (Krasnov, 2012).

Evaluation of the effectiveness of educational resources and their adjustment are carried out, usually using questionnaires control groups of students, which takes into account the digestibility of the material. On the level of assimilation of the material affects the transmission quality, accessibility, visibility and usability of the resource.

The effectiveness of the ESM can be predicted at the stage of analysis and designing of system by conducting system analysis in the formation of the initial requirements and objectives (Gura,2007).

The main task of developing e-learning resources for the specific technical disciplines is formation of professional competences. Competence approach involves the adaptability of the educational process necessary to reach your goals when training. The technological way of achieving educational objectives, the graduate is a "product" whose quality depends on the quality of education. This approach gives the possibility, on the basis of structuring and parameterization of the quality criteria to assess the impact of learning technologies for training of engineers (Norenkov, 2005).

The success of learning process depends largely on the organization of educational material. If the course is designed for training in intensive interaction between the teacher and the student, and requirements for the organization of such a course, the principles of selection, organization and structuring of material, control will be determined by the characteristics of this interaction (Zainutdinova, 1999).

2. Methodology

In the process of the study were used General methods of research: methods of analysis of the educational process: horizontal, vertical, ratio, comparison, and other.

To study the principles of design of electronic educational resources were used General scientific and special research methods:

- review of the regulatory framework;

- analytical method;

- observation;

- learning experience;

- pedagogical experiment and etc.

2.1. Recent research and publications analysis

The technology is based on the formation of the ESM, we offer these scientists laid the psychological and pedagogical requirements, content models, and exploration of the material, the modern concept of educational environment and a method of constructing electronic educational resources, etc (Gura,2007).

Feature of ESM for specific disciplines [1; 6] is to build a learning process based on theoretical knowledge received at studying of disciplines as well as practical experience with real technical devices and systems. The complexity of learning in this area due to the huge range of real technical systems and devices. In these circumstances, it is necessary to ensure understanding of the essence of the processes studied earlier on the basis of the theoretical foundations for successful learning of the fundamentals of design, production and exploitation of entire classes of real technical devices and systems. The complexity of formation of professional competences depends also on the value and uniqueness of the required laboratory equipment, complexity of technological processes and their implementation in educational institutions (Krasnov, 2012).

3. Results

The quality of training include the following basic concepts:

1. technical knowledge – knowledge that provides the graduates the basic skill level of knowledge in the specialty;
2. functional knowledge – knowledge that gives understanding of policies, procedures, practices and functional linkages, which have a significant effect on the efficiency of production systems as a whole (Zainutdinova, 1999);
3. technical aptitude – ability arising on the background of the universal (such as individual psychological characteristics), ensuring successful execution of engineering activities;
4. type of thinking - a kind of constructive thinking with the peculiarities caused by the nature of the activities in the presence of productive, cognitive, analytical, logical, creative types of thinking as its individual characteristics;
5. the thinking person – a person possessing a certain type of thinking and formed in the process of preparing the personal qualities that allow her professionally implemented in the industrial control system;
6. professionalism – the ability to implement professional readiness in a particular specialty on the level of competence acquired by the person in the course of professional activity and brought to perfection (Radchenko, 2003).

With these requirements in the analysis phase, needs to undertake the following tasks:

1. systematization of basic missing knowledge;
2. evaluation of the adequacy of depth of assimilation of materials from introductory disciplines of integration of knowledge of disciplines of cycle GED (general studies) in a cycle of SD (selective discipline);
3. the diversity and complexity of interdisciplinary relations;
4. use the experience of other universities in teaching subjects cycle of SD.

3.1. Key research findings

Since, as already noted, the disciplines of a cycle of SD is inherent in the integrative nature of knowledge, it is necessary to consider the formation of scientific concepts on an interdisciplinary basis with mandatory consideration of the following issues:

1. Consistency over time of studying certain disciplines, in which each of them builds upon earlier conceptual framework and prepares the trainees for the successful assimilation of the concepts of the subsequent discipline (Samples, 2004).
2. The need to ensure continuity in the development of concepts. Concepts that are common to several disciplines, have from discipline to discipline continuously evolve, to acquire new content, enriched with new relationships.
3. Unity in the interpretation of scientific concepts.
4. De-duplication of the same concepts in the study of various subjects.
5. The implementation of a unified approach to the disclosure of the same class of concepts.

The widespread use of e-learning resources creates opportunities for the application of new

information technologies when displaying various models of complex objects taking into account the interdependence of the laws and phenomena of interdisciplinary character, and also provides creativity.

In a unit development, special attention must be paid to the process of formation of educational content in accordance with the educational standard.

Typically, existing methods use a modular system of presenting material. The module has an indefinite volume and can be likened to the topic, paragraph or section of discipline.

Themes can be different in volume, accompanied by a varying number of graphical interpretations, and to upgrade you have to completely change the existing material, which creates problems when it is further adjusted. As example, the sections dedicated to modern achievements of science and technology and their development prospects. These sections are the most rapidly becoming obsolete and may be subject to correction at the stages of design, testing and debugging, which may slow down the introduction of the created resource in the operation and, accordingly, increase the time to develop it or to reduce its effectiveness in the educational process (Zainutdinova, 1999).

This problem can be solved by reducing the volume of the module and giving it the dimension of the term (definitions). This will increase its versatility, simplified replacement process, and will be a reusable object created in a variety of complexes.

Thus was formed the General algorithm of designing the content part.

Through the proposed design approach, a substantial part of educational material is formed by the method of selection and harmonization of concepts, and also implemented a systematic approach to used information. As a result of the analysis conducted during the project preparation stage, reduced the time for testing and debugging a ready educational resource.

At the stage of pre-training for new courses it is necessary to conduct a preliminary analysis of the initial information, which includes: systematization of experience of teachers, the evaluation of the adequacy of depth of assimilation of materials from introductory disciplines, adequacy of integration of knowledge of disciplines of cycle GED in a cycle DM, the diversity and complexity of the interdisciplinary relationships and the expertise of other universities. When the adjustment of the resource in addition to these issues takes into account the results of quality control of specialist training, obtained in the course of operation of the quality management system of the institution (Osin, 2014).

In the analysis phase, the distributed information sources are allocated to main groups of sources that contain the necessary learning information. These include paper sources of various kinds, such as educational and educational-methodical manuals, guidelines, articles and sources with and without paper analogues, are found on the Internet.

4. Conclusions

Modern information technologies in some cases, reduce the time of creation of electronic educational resources compared to traditional educational resources, at the same time significantly extending their life cycle thanks to the possibility of making additions and changes not only in the process of developing e-learning resources, but also in their application in the educational process.

This approach does not contradict previously developed concepts, but expands and complements the methods of working with content and also takes into account modern tendencies of formation of competence, the impact of international and emerging standards of e-learning. The proposed concept of training content is not dependent on the selection conditions of the environment (shell) of the ESM, it is quite versatile and allows to form in the later stages of development of pedagogical scenarios for any type of training.

4.1. Brief description

Effectively developed electronic educational resources include five elements:

1. The display of information;

2. Guidance on what to do;

3. Exercises for understanding and memorization;

4. Assessment to determine the need to repeat or move to the next step;

5. Interactivity.

These five elements can be embedded in e-learning or used in combination of blended learning. Despite the fact that almost all of these items can be implemented without the use of media, multimedia makes them more effective and meaningful. Giving a person the opportunity to perceive the video and audio media has an advantage over each of these possibilities separately (Tab.2). In addition, since the two channels for processing different information, their combination into multimedia is very successful because it uses the advantages of both systems. The connection between text and graphics potentially allow for deeper understanding and better to build a mental model.

Table 2
The principles of efficiency of electronic educational resources

Principles	Description
Multimedia	Training with the use of text and graphics is better than using only text
Spatial relationship	While teaching, accompanied by text and graphics is better when corresponding text and graphics are placed next to each other
Temporary link	While teaching, accompanied by text and graphics is better when corresponding text and graphics are displayed simultaneously, not one after another
Consistency	When training it is better if the text, graphics, or sound is not redundant.
Modality	When learning is better when animation is accompanied by narration than animation accompanied by onscreen text.
Redundancy	When learning is better when animation is accompanied by narration than if the animation is accompanied by narration and on-screen text.
Individual differences	The effect of these principles more strongly expressed when learning the initial knowledge than the knowledge of a high level, and for very remote students than for geographically remote little

Note: compiled by the author according to the results of the study (Salbyrova, 2017)

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