Development and Implementation of Multimedia Educational Technologies in the Educational Process of Higher Educational Establishments

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ABSTRACT

The authors concluded that various components of the educational environment of the management personnel are poorly connected to each other. The stages of education and the content of educational programs are not an integrated whole. Information technologies and computer learning tools dominate nowadays. The authors analyzed the status of multimedia technology in the educational process. An effort to create the methodology, the technology development and the implementation of learning software was made.

The authors suggested the main stages provided by the technology for creating multimedia textbooks. The development of multimedia textbooks, according to the authors, involves four stages: conceptual design, development, implementation and preparation of the product for distribution.

The research on the extent to which the electronic textbook provides individualization of teaching has been performed in the course of the experiment based on the analysis of the learner's perception of the multimedia textbook. Students of State University of Management (Moscow) and Samara State Technical University (Samara) have been tested.

The aim of the first phase of the experiment was to obtain information on the duration of one session with different forms of information in a multimedia electronic textbooks (text, text and graphics, text and sound, graphics and sound).This measurement was carried out under an unlimited period of time (maximum or unfixed).

The second phase of the experiment was aimed at determining the percentage of students who have familiarized with all forms of information in a multimedia electronic textbooks for a minimum period of time.

The investigation of the time factor effect on the understanding of the studied electronic multimedia textbook was a separate objective ("immediately after learning," "a week after the study"). It was obtained in the third phase of the experiment based on testing of the students using a three-point scale ("satisfactory", "good", "excellent") in two contexts: 1) immediately after learning of the electronic multimedia textbook; 2) a week after the study.

Keywords

Multimedia, multimedia educational technology, educational process, multimedia textbooks, distance learning technology, continuous vocational education

1. INTRODUCTION

The last century and the beginning of the current one have been marked by the explosion of information available. The set of the terms "information" and "technology" form the term *information technology* which can be characterized as a set of methods, techniques, tools that provide storage, processing, transmission and display of information focused on the improving of the efficiency and productivity.

Information technology is an indispensable part of most kinds of intellectual, managerial and production activities of man and society. The development of information technology nowadays is based on the use of computing tools and related methods and means of automation of information processing.

2. MULTIMEDIA TECHNOLOGY IS ONE OF THE ELEMENTS OF INFORMATION TECHNOLOGY

Multimedia technology is a computer system that provides the ability to create, store and replay heterogeneous information including texts, sound, graphics, pictures, video, animation. An important feature of multimedia technology is a high-quality presentation of all the constituent components of the data, as well as the possibility of their related or complementary use. Multimedia technologies are widely used in the content development for e-learning.

The term **multimedia** is a Latin word which penetrated from the English sources into various languages almost in the original transcription. Sometimes it is pronounced in the English way. It's a combination of the English words *multy, multiple* (consisting of many parts) and *media* (environment, means, method) or, more precisely, from the Latin words *multum* (a lot) and *media, medium* (center, means, method). Thus, literally, *multimedia* means *many environments*.

The term *multimedia* seems to be clear but there is a lot of nuances which remained to be clarified, as the nature of the *multimedia* is much deeper and more complex, and its characteristics are in the "embryonic" stage of the study.

As multimedia technologies are integrated, the sub-elements of these technologies have come to be known as independent terms, where the word *media* is used as an adjective: multimedia processes, multimedia systems, multimedia programs, multimedia products, multimedia services.

Multimedia resources are different from *non-multimedia* ones mainly by the following facts:
1) the data (information) is stored and processed in the digital form using a computer;
2) they may comprise various types of information (not just a text, but also sound, graphics, animation, video, etc.);
3) their essential feature is interactivity, i.e., the active cooperation of resources, programs, human factors and their mutual influence;
4) presence of a hypertext (1).

Experience has shown that multimedia technologies are becoming increasingly important in management training. They help to obtain the objectives of training (to prepare a specialist) using technical and human resources, and their interaction.

Multimedia technologies are practical applications of modern scientific methods and decision-making tools. When introducing innovations in the educational process, new methods and techniques are included. This is because any techniques and methods can not exist outside a certain management, actions, procedures, i.e., outside the technology. But if this sequence is not recognized as a technology (as a kind of integrity), the process consists of training on an intuitive basis and common sense, there are no unified scientific and methodological approaches.

The conscious design of multimedia technologies helps to avoid unnecessary and minor procedures and duplication of work, to formulate clear criteria for quality of results. Multimedia technology can enhance the effect of human activity not through separate elements but their combination in a single system. At the same time it makes a reasonable orderliness in training by introducing rules and regulations for separate operations, especially with respect to routine, stereotyped procedures.

The basis of media technology in the management training includes the selection and structuring of educational material, the choice of methods, techniques, methodologies, integrated methodological

support, testing of technology feasibility, the organization of joint activities of teachers and students, the mode of technology development and the monitoring of management training results .

The selection and structuring of educational material were implemented in the existing federal state educational standards of higher education in the areas of training and specialties, in exemplary basic educational programs of higher education within the federal state educational standards and in the academic programs of each individual higher education institution that train managerial staff .In accordance with the Russian Federal Law on education the mandatory federal state educational standards should be combined with the autonomy of universities and academic freedom. They do not contradict each other, since the institution is independent in its scientific and educational activities and recruitment. The content of multimedia technologies in the management training with the highest qualification is determined not only by the state standard requirements. The needs of the labor market, qualified teachers of high school and the basic education of the students are also of great importance.

We are convinced that there is no single approach in the development and implementation of multimedia technologies in management training. So in this paper we suggested the recommendations for choosing of the methods, techniques, procedures, specific components and assessment of multimedia technologies in management training in high school. The roles of students and teachers, as well as their joint activities in the implementation of multimedia technologies for management training were investigated as well.

The development of new elements of multimedia technologies for management training includes the following stages:

1) the research of aims and the content of the components of multimedia technologies for management training to establish the dependence of the results on a variety of factors and conditions; identification of the major contradictions in existing technologies of management training and the problem statement;

2) the study of the implementation of multimedia technology for management training (or its components), areas of unrealizability, identification of existing restrictions (temporary, technical, technological, psychological and resource constraints); identifying the criteria for achieving the objectives in management training and the optimization criteria for multimedia technology in management training;

3) development of several variants of the content and the structure of the particular academic subject, unit or theme, the choice of the dominant one;

4) development of the selected dominant variant;

5) development of several multimedia technologies for management training of the specific academic subject, unit or theme of the discipline;

6) development of the components of multimedia technology in management training (tests, games, case studies, business games, multimedia, hypertext and multimedia textbooks, etc.);

7) pilot project implementation of the components of multimedia technologies;

8) introduction of changes in the components of management training technology based on the results of the pilot project;

9) carrying out, if necessary, an additional pilot project implementation of the components or their rejection.

For the effective development of multimedia textbooks and computer-based training systems it's necessary to know the capabilities and characteristics of all types of learning software.

Learning software (LS) is a software tool (software package) or software and hardware package designed to solve specific pedagogical problems. This package has subject content and is focused on the collaboration with the student. This definition shows that LS is the best tool for solving educational tasks.

Subject content means that LS should include educational material on a particular subject area (an academic discipline, a course, a unit, a theme). The training material referred to either the declarative information (descriptive, illustrative) or knowledge and skills tests, as well as models and algorithms that represent the studied objects and processes.

The focus on the self-directed learning is the key aspect of LS. At the same time it is not an integral feature, since there are some LS designed for group tuition (e.g., multi-role simulators).

While developing LS technology some new varieties were created, they have some key features. Firstly, LS was designed as an electronic analogue of study guide on paper (automated tutorials, problem books, manuals, etc.) Secondly, the LS had technical functions, not computer based training means. So, more

multifunctional, compact and less expensive computer training systems and laboratory workshops appeared. Third, LS were associated with the types of studies and activities to support them. The latter led to the selection of multimedia lectures, automated tests, boundary control and others. Finally, fourth, LS were associated with the educational objectives they were addressed to. The last aspect represents the appropriate automated remedial lessons, knowledge testing systems, etc.

The focus on the educational task is reflected in the definition of LS given above. Let's identify the following main pedagogical objectives that can be solved using LS:

1) an initial introduction to the subject area (SA), understanding of basic concepts;

2) basic training at different levels of details;

3) development of skills for best practical solutions in the subject area;

4) development of the skills of analysis and decision-making in non-standard situations;

5) development of the skills for certain types of activities;

6) conducting educational research experiments with the models of objects of study, processes and pedagogical activities;

7) knowledge and skills recovery (for rare situations, challenges and technological operations);

8) monitoring and assessment of knowledge and skills levels .

In spite of the integral character of these objectives, their decisions have strong effects on each other. Therefore, types of LS, as a rule, refer not to specific objectives but to the groups of the most correlated objectives.

The technology of MT creation involves the following main kinds of work:

- formation of the product concept;
- preparation of training material and training tasks (TT);
- methodical processing, coordination and editing of educational material and TT;
- software implementation and debugging of software components;
- development of computer graphics;
- development of multimedia components (video, sound, digitizing data, animations and 3-D interactive presentations);
- user interface design (UI);
- formation and integration of information components;
- development of operational documentation and promotional materials;
- project management.

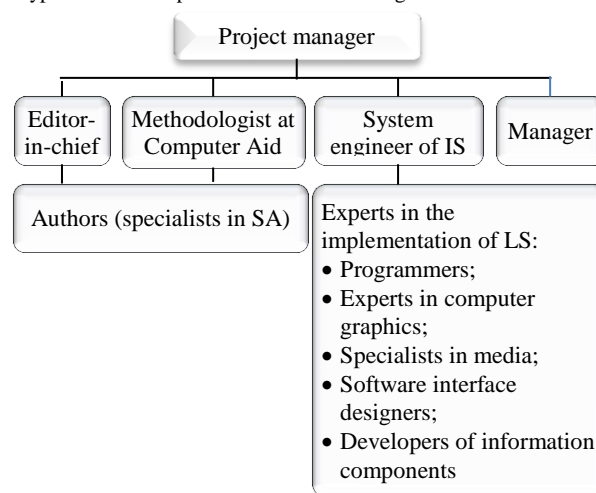A typical MT development team is shown in Figure 1.

Fig. 1. Development team of MT

The project manager is the editor–in-chief, a computer supervisor or a system engineer of LS. The responsibilities of the project manager are as follows:

- collaboration with the customer (Feasibility Study, agreement)
- formation of a team of performers
- providing overall coordination of work
- implementation of the project
- signing a contract and design specifications.

The editor-in-chief is responsible for the preparation of teaching material and TT, ensures their coordination and editing. The computer supervisor can also solve relevant problems if he is a profound expert in the subject area.

The team of experts for the implementation of LS is formed according to the types of jobs.

The manager controls the project and is responsible for material, technical, legal and financial support. It is important that the manager can't be the author or the developer. In this case, it is much easier to monitor the performers not falling into offense of the product improvement and stretching deadlines due to any *objective difficulties*. The ultimate goal of management is to ensure the implementation of the project on time without exceeding the planned cost.

It must be stressed that diagram in Fig. 1 reflects the main objectives of the project and the respective competences of the performers. In some cases specialists included are determined by the characteristics of the product being developed, planned deadlines, financing, etc. For example, a 8-10 hour training package of average complexity can be designed for a period of 2-3 months by the team including one or two authors, a computer supervisor and one or two programmers.

This paper presents the basic stages and process steps of the development and implementation of multimedia textbooks:

- conceptual design;
- design;
- implementation;
- preparation of the product for distribution

1) The first stage *Conceptual design* is the creation of the concept and the image of the product by defining its main functions and characteristics, searching the structure and the content of the educational material and TT, deriving all major educational and software solutions. Conceptual design is the most complicated and the major stage of the project. Most tasks are creative and difficult to formalize. It can be said that the content of the conceptual design is the formation of the product sketch on paper. The results of the work are also presented in the form of electronic documents: specifications, diagrams, descriptions, diagrams, etc. These materials belong to the developer documentation and are not included in MT information components.

2) The second stage *Design* includes creating templates of information components, MT software interface and application prototype. The data structure and performance algorithms of functions (not provided with author tools) are also carried out at this stage .

3) The third stage *Implementation* includes preparation, methodical processing, coordination and editing of educational material and TT; their representation in MT information database ; software implementation and debugging; creating the operating instructions. This stage results in complete LS(MT).

4) The final stage *Preparation of the product for distribution* contains Licensing of Intellectual Property Rights

3. DEVELOPMENT AND IMPLEMENTATION OF MULTIMEDIA TEXTBOOKS IN THE PROCESS OF TRAINING SPECIALISTS

Creating personal willingness to live in the information society is becoming one of the priority objectives of contemporary education. The main features of this society include dynamic changes in nature, society and environment; dramatically increased scope of information; the rapid development of information and communication technologies that influence all areas of the life of the individual and society. The quality of training staff with the highest qualification is very demanding. High dynamics of information technology in the last decade leads to the updating of basic vocational training. In this context, continuous education is to be a key component in the system. The development and implementation of new information technologies able to ruin the barriers and create favorable conditions for quality education of large segments of the population offer new prospects. In particular, the most important feature of the use of new information technologies in education is to provide learning opportunities at a distance. The new information technologies became the basis of a fundamentally new form of training known as distance learning that is actively gaining global educational space and is regarded as dominant in the future system of education.

Distance learning can be defined as a purposeful process of interaction between a teacher and a student based on the use of new information technologies at a distance. Based on the independent work of students it allows to learn the studying subject more effectively. Distance learning makes possible to manage the cognitive activity of students as well. Student-centered learning focuses on the virtual learning environment which is provided irrespective of the location of the learner at a comfortable pace and keeps his usual lifestyle. This type of learning can provide dynamics, democracy, flexibility of the continuing education. Based on modern training information technologies the system of distance learning provides a variety of educational services, enables continuous learning and supplies advanced professional knowledge. Distance learning involves planning of the training by drawing up an individual training plan, the choice of the place, time and pace of learning. The advantages of this system are the mass character and accessibility, provision of continuing education, simplicity of training and retraining courses.

The key element of distance learning is the specialized information and educational environment which allows to implement modern educational technologies. In addition to the resources and software tools it combines intellectual resources of schools. They include structural units of higher education institutions (involved in the development and implementation of information technology in the learning process), teaching staff, researchers and employees of the administrative and technical staff. The rapid development of high quality e-textbooks is required for filling the educational environment and for the effective use of local and global computer networks.(2).

The key teaching system of distance learning is an e-MT. In fact, it is the basis of the teaching educational environment, presenting a higher stage in the educational process. E-textbooks can be performed on any electronic media or placed in a local or global computer network.

Cost-effectiveness of the e-textbook includes the development cost and optimal set of technology tools. According to foreign sources (3), software development of 1 hour of study is equal to 50-500 hours of skilled programmers' labor. Therefore, the cost of 1 hour of e-learning course can be up to $ 10,000. It should be emphasized that we are talking about the costs related to the technology of programming. This technology should set a clearly defined target suitable for the needs of a particular academic discipline. Target-setting and preparation of all initial information (content of data support of distance learning) is the teacher's prerogative.

Assessment of the quality and effectiveness of electronic multimedia textbooks is a complex and multi-faceted problem. Individualization of learning is one of the important aspects. Some researchers and developers associate individualization with the interactivity, i.e. the ability of the students to choose their own ways of study. This statement has been tested by experiment.

The aim of our experiment was to consider the extent to which the e-textbook provides individualization of teaching. To analyze the perception of the multimedia textbook 74 students of the State University of Management (Moscow) and Samara State Technical University (Samara) were involved.

During the first phase of the experiment the objective was to define the duration of one session with different forms of information in a multimedia electronic textbook (text, text and graphics, text and sound, graphics and sound). This measurement was carried out under an unlimited period of time (maximum or unfixed). The results of the experiment are presented in Table 1.

Table 1. Time required for familiarization with various forms of information (non-fixed time)

Forms of information	Average time (min)
Text	14,35
Text and graphics	15,46
Text and sound	17,07
Graphics and sound (Flash-animation)	17,67

The second phase of the experiment aimed at determining the percentage of students who familiarized with all forms of information for a minimum period of time limited to 20 minutes. The results are presented in Table 2.

Table 2. Number of students (%) familiarized with all forms of information (fixed time)

Forms of information	Number of students (%)
Graphics and sound (Flash-animation)	91
Text and sound	79
Text and graphics	63
Text	57

The investigation of the effect of the time factor ("immediately after learning," "a week after the study") on the studied information was a separate objective. It was solved during the third phase of the experiment based on testing of students using a three-point scale ("satisfactory", "good", "excellent") in two contexts: 1) immediately after learning of the e-MT; 2) a week after the study. The results are presented in Table 3.

Table 3. Assessment of students (%) in the context of different time periods

Forms of information	Testing time					
	Immediately after learning			A week after the study		
	satisfactory	good	excellent	satisfactory	good	excellent
Text	32	40	28	48	32	20
Text and graphics	29	29	42	37	23	31
Text and sound	29	41	30	38	34	28
Graphics and sound (Flash-animation)	28	27	45	35	30	35

The experiment conducted confirmed the known relationship: individual perception of the forms of information (preference of textual, audio or video) are determined by the psychological types: auditory learners, visual learners ,digital learners or tactile learners. Therefore, based on all above the following conclusions were made:

1. For more successful learning of e-MT material we need to develop and implement tests to define students' psychological types (auditory learners, visual learners ,digital learners or tactile learners).

2. Development of appropriate methodology considering psychological types of students should be taken into account when creating e-MTs. It should be stressed that the quality of e-MTs could have a convincing opportunity for improving considering individual characteristics of students and interactive learning tools in spite of any additional cost (intellectual, time, financial).

In the future the development of adaptive expert system based on students' test results will determine the method of material presentation in e-MTs. It is quite complex and painstaking work that will be crucial for the further introduction of e-MTs in the educational process in the next few years.

REFERENCES

[1] S. Golubitskiy, «New Mythology Internet», Expert (№ 27), pp. 54-55, 1997.

[2] V. Balashov, «Modern problems of management of reproduction of scientific potential of Russian higher school", M: Publishsing house GUU, 2001.

[3] N. Patapskaya, «Economic aspects of development of scientific and educational capacity of the higher school, Thesis: Candidate of Economic Sciences, Omsk, 1997.