

Multimedia Systems in Education

Zhanna Deineko¹, Svitlana Sotnik², Vyacheslav Lyashenko¹

¹Department of Media Systems and Technology, Kharkiv National University of Radio Electronics, Ukraine
e-mail: lyashenko.vyacheslav@gmail.com

²Department of Computer-Integrated Technologies, Automation and Mechatronics, Kharkiv National University of Radio Electronics, Ukraine

Abstract: *The paper conducts review of multimedia systems in education, during which advantages and features of application are highlighted. Educational electronic resources in education are described in detail. The main elements of MS are given, three main types of such systems are considered (H-media, Interactive and Live video); examples are given and advantages and disadvantages of each are defined. During analysis of MS use in education, 4 main characteristics and key principles of such systems that must be adhered to when creating multimedia are highlighted.*

Keywords—learning; multimedia application; educational purpose.

1. INTRODUCTION

The current trend is associated with introduction of various kinds of information tools into educational process.

The development of information tools becomes prerequisite for emergence of multimedia systems in powerful industry.

Multimedia systems (MS) are one of tools in informatization of education, which is based on electronic educational products. At the same time, MS can use various methods and approaches that are used in other areas [1]-[9].

Multimedia or multimedia systems are set of computer technologies that simultaneously use several information environments: graphics, text, video, photography, animation, sound effects, high-quality sound.

Now, due to COVID pandemic, multimedia systems are increasingly being used in distance learning, as they have convenience of human-machine interaction:

- flexibility – ability to study at convenient pace;
- scale – simultaneous access to many information sources of large number of students;
- portability – ability to study at right time and in convenient place;
- convenience – multimedia systems, combining images and audio files into single presentation or project;
- increasing motivation of trainees.

In this case, educational process itself becomes media educational by nature of its implementation, which means that optimal learning can be achieved by combining visual and verbal information.

The process of visualization is representation of mental conclusions into visual image that can be expanded and can serve as support for adequate mental and practical actions.

Thus, MS contribute to formation of professional thinking by systematizing and highlighting most significant elements of training, that is, topic of work is always and will be relevant.

Multimedia applications can be used in many areas, such as in areas such as education, businesses, homes, and public spaces. For educational purposes, students can learn variety of information for further understanding through multimedia applications [10].

2. RELATED WORK

In existing modern sources, authors cover in detail roles and applications of multimedia in various educational and educational contexts, as well as case studies of development and use of multimedia, including areas such as language learning, cartography, engineering education, medical sciences and others.

Multimedia plays an important role in educational sector, and these multimedia are video, virtual reality, 3D printing, etc., and finally, for freely available applications, institutions provide students and teachers with opportunity to use social networks, software and many other applications for their learning process [11]-[15].

Moreover, use of MS is possible both for teaching humanities, technical sciences, and for physical development [12], [13].

Due to specifics of music education, multimedia and network technologies are used in teaching much less often than other disciplines, but there are also such examples of MS use for music education given in [14].

The advantages of interactive media to stimulate senses of designers, innovations in educational environment of artistic design are described in [15].

In [16] authors analyze importance of integrating multimedia in online education and how it can create students to pursue media entrepreneurship. The paper describes advantages of multimedia systems and how they are used.

Intellectual Computer-Aided Artificial Intelligence (ICA-AI) – multimedia lectures, exercises, research, reviews and moderation of debates based on higher education platforms considered in [17]. Genetic Algorithms (GA) are Multimedia model in [17]. The issues of designing and developing multimedia class are also considered.

In [18] analyzes definitions of concepts, terminology used, differences, fundamental points of view, advantages, disadvantages and, finally, similarities and differences of e-learning (e-learning), mobile learning (mobile learning). and d-learning. Such types of training also use multimedia systems.

3. EDUCATIONAL ELECTRONIC RESOURCES

The review will begin with resources – educational electronic resources (Fig. 1).

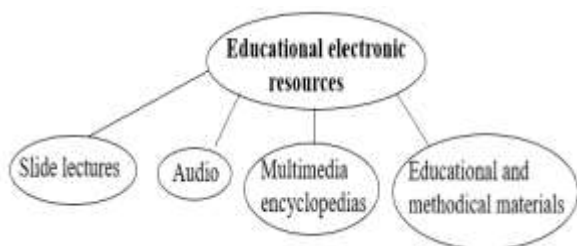


Figure 1: Educational Electronic Resources

Currently, sound information (audio materials) is an integral part of any multimedia system. When working with sound, it is important to know not only basic features of programs used in creation of audio multimedia components, but also basic formats and parameters of digital audio.

Important role when working with sound is played by understanding processes of converting analog sound into digital form. The most obvious way to store sound digitally is through time and amplitude discretization.

A multimedia encyclopedia (ME) is organized collection of textual information, graphics, videos, and sound clips. Some publications can be focused on ordinary person, others – on specialist. There are many educational encyclopedias designed for children.

Key feature of multimedia encyclopedia is its hypertext structure. Speech is often used in MS. Voiceover, focusing on main ideas set forth in encyclopedia.

Educational and methodical materials – serve to systematize knowledge, formation of practical skills. For most effective training, it is necessary to present training materials in various forms. The multimedia course is means of complex impact on student by combining conceptual, illustrative, reference, training and controlling parts, and basis is interactivity.

Slide lectures are form of material presentation, which makes it possible to pay attention to significant moments of

information presented, using visual spectacular images in form of illustrations, photos [19].

4. FEATURES OF APPLICATION AND TYPES OF MULTIMEDIA

The need to use new technologies in educational process, ability to present an increasing amount of material in short period of time – one of solutions to such issues is creation and use of multimedia systems.

In course of applying MS, it is necessary to take into account key selection criteria:

1. Target audience. It is necessary to have an idea of training materials content (video, sound, statistics, etc.) in order to understand whether such form of MS is suitable for particular audience. Determine whether level of materials complexity of target audience is adequate.

2. User-friendly interface. Easy for users to explore, remember and present information.

3. Flexibility and navigation. How easy it is for users to get required knowledge, perform necessary tasks, using system of references presented in application.

4. Quality of technical implementation. Slow and unreliable applications or applications with unsuccessful designs quickly lose popularity among users. Assessing quality of technical implementation of application includes following aspects: interactivity, performance, functionality, reliability and extensibility.

Existing MSs may include following elements (Fig. 2).

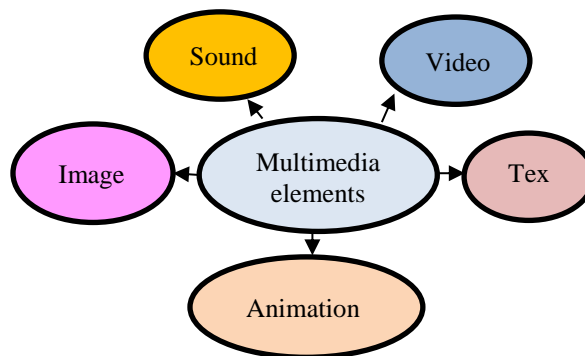


Figure 2: MS elements

Text. All multimedia contains some amount of text. Text can have different of font and size to suit presentation. Text use in multimedia can be perform in different format general Text, hyper text, pdf.

It is known that person perceives most of information with organs of vision (80 %) and organs of hearing (15 %).

That is, to simplify perception of information, it is possible to use various elements of multimedia data. For example, to

provide information not only in text form, but also to illustrate it with audio data or video clip.

Video films (clip) – technology for developing and demonstrating moving images.

Consider pedagogical issues of multimedia use in education, while criteria for choosing MS were given above.

All multimedia applications are divided into following types:

1. Presentations – combination of computer animation, graphics, video, music and sound, which are organized into single environment. As rule, presentation has plot, scenario and structure organized for convenient perception of information.

Presentations are:

- linear presentation – dynamic video with complex graphics, video inserts, sound and absence of navigation system;

- interactive presentation – set of multimedia components, structured according to hierarchical principle and controlled through special user interface.

2. Animated videos – reproduction of pictures sequence, creating impression of moving image.

Animated videos can be classified as:

- frame-by-frame animation – frame change of images, creating impression of pictures movement;

- programmatic animation, animation in which images are changed using programmed sequence of actions (i.e., algorithm and variables) Drawing main objects is done manually, or importing them from collections and galleries, after which capabilities of programming language are applied.

3. Games are multimedia applications aimed at satisfying needs for entertainment, pleasure, stress relief, as well as development of certain skills and abilities [20].

Educational games – programs that allow user to increase level of his knowledge in particular area, presented in easy game form.

4. Video applications.

- multimedia galleries – collection of images.

5. Audio applications (sound file players).

6. Applications for web are separate web pages, their components (menu, navigation, etc.), applications for data transfer, multi-channel applications, chats, etc.

Thus, taking into account selection criteria, most rational form of information presentation can be applied.

If we consider issues of training with multimedia use from student point of view (provided that there is choice), then everyone decides for himself which of types is suitable for

him, therefore, we will highlight main types of multimedia (Fig. 3).

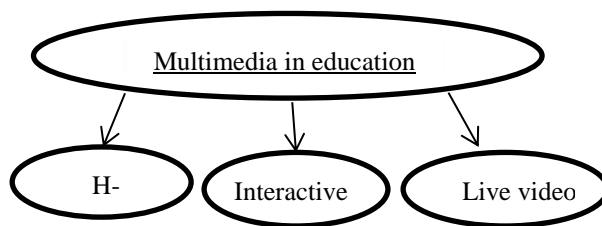


Figure 3: Types of MS

H-media is "multi-channel database" that displays on monitor, in addition to textual nodes (hypertext system), fragments consisting of animation, graphic images, sound, music, speech and video files [19].

In field of education, H-media is adapted and specified accordingly to needs of learning environment, acting as educational tool, carrier of information, technical system.

Advantages:

- flexible navigation – random access to H-media elements by establishing hyperlinks;

- high degree of interactivity;

- "individualized" use of educational materials;

- ability to access various external databases.

Disadvantages:

- when working, person may encounter disorientation in navigation environment of hypertext space;

- need for coordination: perception of information on one channel should enhance perception of information on another channel. Image composed by superimposing background image, dynamic object, animation, sound and speech and text favors manifestation of synergistic effect in its perception;

- impossibility of changing material.

Next, consider interactive (multi) media, system that provides ability to arbitrarily control video image and sound in dialog mode [19], [21].

Advantages:

- allows possibility of placing interactive web elements in it, for example, tests or workbook;

- user can control what appears on screen and in what order;

- possibility of studying materials at pace acceptable to students;

- presence of interactive interaction with teacher.

Disadvantages:

- impossibility of changing material.

Next, let's look at Live video – such system is capable of working in real time, for example, IBM developments: Linkway Live and Storyboard Live [22], [23].

Considering LinkWay, here main concept of system is folder.

Folder is basic workspace of application created in LinkWay (Fig. 4).



Figure 4: LinkWay system

Folders can be connected, linked, etc. Folders are divided into pages – screens with information contained on them. Each folder contains basic page with general information for all pages [22], [23].

The remaining pages are numbered in order.

When you render page on monitor screen, image of current page is overlaid on base page.

Thus, elements common to all pages can be placed on base page, and they will automatically be present on all pages of folder.

Objects in LinkWay can have names: this is useful when you plan to respond to various objects to user actions – you can call object by its name.

LinkWay also has set of graphic primitives: lines, broken, rectangles, etc., which can be used when designing program.

Advantages LinkWay:

- development of demonstration videos on various topics;
- allows you to implement differentiated approach to each trainee and model fairly wide range of processes;
- any user who has free account can upload media files to LinkWay Internet Archive. LinkWay allows you to save copies of works of many specialists in special collections.

Disadvantages LinkWay:

- lack of standard interface;
- impossibility of adding new elements to existing ones;
- orientation of system to MS-DOS OS;

- extremely limited set of objects and visual effects;

- poor palette of colors and low-resolution graphics;

- impossibility of creating executable modules that could work regardless of presence of LinkWay system itself.

Experimental StoryBoard Live application that uses artificial intelligence to turn videos into single-page images (see Fig. 5). Storyboard only works on Android so far.



Figure 5: Collage images in Storyboard

Storyboard advantage – application is quite simple: user only needs to select video that he wants to turn into "collage of images".

Storyboard analyzes content and then selects, processes, and combines most interesting footage.

Storyboard disadvantage – it is impossible to change details of resulting "collage of images", but if user swipes his finger across screen from top to bottom, Storyboard will generate new "collage of images" from same video.

Example of system that was ancestor of media systems and was widely used, since for long time it was free of charge bundled with basic Macintosh software is HyperCard system (Fig. 6).



Figure 6: HyperCard System

In HyperCard system application (stack), you can work with elements: background, cards. In this case, all these elements can contain fields (fields) and buttons (buttons). Each

of these objects can be associated with special descriptions (scripts) to indicate interaction of this object with other objects of HyperCard system, as well as with operating environment, mouse and keyboard [24].

Interactions in HyperCard are carried out using messages.

So, here main point is that HyperCard application is "assembled" from cards with buttons.

Advantages of HyperCard:

- ease of use, thus, during the existence of HyperCard, many applications and extensions have been implemented.

Disadvantages of HyperCard:

- to work with stack (HyperCard application), you must have HyperCard system on your computer;

- despite many extensions and additions available, system is not very suitable for implementing such user interface features as color work, support for floating windows, etc.

5. CHARACTERISTICS OF MULTIMEDIA SYSTEMS

In educational process, multimedia products act as means of communication, as well as expressive tool in various pedagogical scenarios.

In course of review, general characteristics of MS are highlighted:

1. Reliability of information. Since any electronic product must be characterized, in most general representation, by content and navigation.

Content is meaning of multimedia "product", formalized in main information blocks. Moreover, information block is understood more broadly than set of data for memorization. It is not only about transmission of information in broadcast mode, but about development of skills and abilities (including research).

2. The design of MS should increase interest of students and presentation of all important information.

3. Interactivity with possibility of expanding sector of independent work and distance learning. Here it is also important that learning people receive feedback from system, during which it is clear about correctness of their answer, which was visualized on screen.

Here you should also take into account such feature as level of interactivity:

- simple (passive) level – minimum of user actions and small functionality of interactive. A simple level of interaction includes, for example, managing presentation – starting, stopping, returning to previous fragment.

Often, simplest means of navigation are used: scrolling, scrolling through text, clicking on hyperlink, etc.

- limited level of interaction with learning product is formulated as process in which student responds to individual learning requests. An example would be testing performed as selection of one or more elements from presented set;

- full level of interactivity – variety of student's reactions to numerous learning requests and expansion of interaction ways range. In this mode, manipulation of objects on screen, use of speech recognition, use of simulation modeling, complex navigation adapted by computer to level of current knowledge of user are assumed;

- level of real time scale – involvement of student in interaction with environment that simulates real objects and processes. The user manages elements of environment, responds to complex training requests. That is, full use of interactive, multimedia and modeling, forming learning environment close to virtual reality.

4. Extensibility. Possibility to update MS materials by adding new blocks.

The basic principles of multimedia systems include:

- representation of information using combination of many human-perceived media;

- presence of several storylines in product content;

- artistic design of interface and navigation tools.

There are number of MS development environments that allow you to create full-featured multimedia applications, for example, packages: Macromedia Director, Macromedia Flash or Authware Professional, are highly professional and expensive development tools, while FrontPage, mPower 4.0, HyperStudio 4.0 and Web Workshop Pro are their simpler and cheaper counterparts.

Tools such as Power Point and text editors (such as Word) can also be used to create linear and non-linear media assets.

The multimedia application development environment is also Borland Delphi. These development tools are provided with detailed documentation that is easy to read and understand.

6. CONCLUSION

The paper conducts review of multimedia systems in education, during which advantages and features of application are highlighted. Educational electronic resources in education are described in detail.

The paper presents main elements of MS, considers three main types of such systems (H-media, Interactive and Live video); examples are given and advantages and disadvantages of each are defined.

During analysis of the use of MS in education, 4 main characteristics and key principles of such systems that must be adhered to when creating multimedia are highlighted.

So, different formats for providing information make it possible for student to interact with information, so online multimedia is increasingly becoming object-oriented, allowing user to work on information without having specific knowledge.

Summing up, we can say that peculiarity of this work is that issues of teaching and learning with use of multimedia learning tools are considered both from standpoint of teaching and from standpoint of learning, as well as from practical point of view.

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