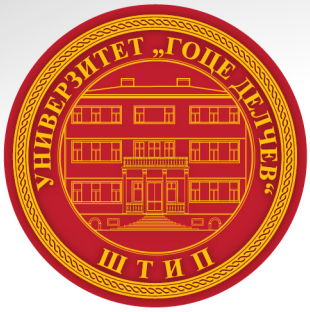

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Редакција и администрација
Универзитет „Гоце Делчев“-Штип
Факултет за информатика
ул. „Крсте Мисирков“ 10-А
п. фах 201, 2000 Штип
Р. Македонија

Address of the editorial office
Goce Delcev University – Stip
Faculty of Computer Science
Krste Misirkov 10-A
PO box 201, 2000 Štip,
R. of Macedonia

СОДРЖИНА
CONTENT

MULTIMEDIA TECHNOLOGIES IN ENGINEERING EDUCATION

D.Minkovska[1], L.Stoyanova[2]

[1] *Technical University of Sofia, Bulgaria, daniela@tu-sofia.bg*
[2] *Technical University of Sofia, Bulgaria, lstoyanova@tu-sofia.bg*

Abstract: This paper reveals some aspects of the application of multimedia technologies in the engineering education. Some of the basic approaches used in the actual multimedia education and theirs integration of various specialized products are reviewed. The trends in using multimedia in engineering education are presented. The conclusions for the future usage of multimedia in the engineering education are drawn.
Keywords: *multimedia technologies, engineering education, e-learning, multimedia lecturing, multimedia tutorials, test systems.*

1. Introduction

The multimedia has been used in many fields like advertisement, engineering, education, etc. Recently, an exponential growth of the usage of multimedia technologies could be seen in the engineering education. The engineering education is one field where the multimedia is a tool of education from one side and from another side it is a subject of the education. Many students possess knowledge in the field of basic multimedia products, but for sure they do not have the deep technical knowledge to take professional decision for the selection of equipment, technology, and implementation for a multimedia project for the realization of a specific practical problem. Therefore, one of the important approaches to the quality and efficient engineering education is the joint application of computer technology with other IT methods and tools such as sound, graphics and video equipment. Thus the students' curiosity is stimulated and the knowledge of specific technologies and methods for the implementation of specific projects is easily perceived by students.

The usage of multimedia, together with heterogeneous technical environment creates conditions for the organization of mixed architectures that can be managed automatically in interactive mode. Computer-aided design is an integrated part of the learning process and, in combination with modern multimedia technology contributes to improving the quality of engineering education. The usage of the multimedia in the engineering education grows instantly because of the advantages it gives for both sides in the process of education – the lecturers and the students [10]. The advantages of using multimedia in the engineering education are – the students can practice their knowledge in the subject in a vivid way through simultaneous animations, video and so on. The learning with the help of multimedia becomes learning through discovery.

No one of the lecturers that are in the habit of usage the multimedia would ever decide to go back and use only the chalk and the blackboard. The students get used to the multimedia and do not prefer the lecturing, traditional in the past.

2. Basic Concepts and Principles of Multimedia

Multimedia is an informational environment that integrates voice, text, graphics, sound, video and animated images [1]. The integration of all these media is possible because of the development of computer technology. The effect invested in the term "multimedia" is a combination of more than one media, a kind of multi-dimensional environment for the presentation of informational objects. In order to be classified as multimedia it is necessary to add to the informational product sound and interactivity.

The term "multimedia technology" is used to mark an integrated computing environment, which create and use applications that process text, graphics, and animation, sound and video images in a dialogue with the user. Multimedia systems are systems that use more than one media - text, graphics, sound, animation and video. Multimedia systems need to include a variety of media, not just a sound or a few graphics to have a good quality output, and various media must be fully covered and they should have a binding ratio adapted to the specific characteristics of training [1]. The most important feature of the multimedia environment is the opportunity for a dialogue with the user, which determines the quality of "interactivity" of multimedia. The interactive mode of information exchange between the user and the multimedia application allows repetition, interruption or change in the performance of operations and setup of the interaction according to the individual user.

The choice of the multimedia environment is an important process in the development of complex interactive applications, where the information flows two-way - from the application to the user and vice versa.

3. Review of the application of Multimedia in the Engineering Education

In the education sector, the multimedia is an alternative to traditional training methods. The learners have the opportunity to explore, examine and learn different parts of the supplied amount of information. Each of the learners can learn according to his potential.

Currently, the usage of the multimedia software in education occurs mainly in two ways [2]:

- The first, the most widely used approach is the so-called teacher-based classes, where multimedia classrooms equipped with digital projectors and digital boards, visualizing images of the projects, and audio amplifiers to increase the power of the audio output from the audio adapter to the computer. This method is suitable for group training of the learners - lectures, seminars. Requires direct presence and trainers and trainees should be in one and the same place.
  The most widely spread in praxis way in using this approach is the usage of PowerPoint presentations. An example of it could be seen on fig. 1. where an animation has been used to help and improve the oral explanation of performance of the SQL for a lecture in the discipline of databases. The step-by-step completion of the SQL statement by the database management system is presented. The way of such explanation of the performance of the SQL statements helps the students to become skilled at understanding the nature of SQL and help them to write their own statements.

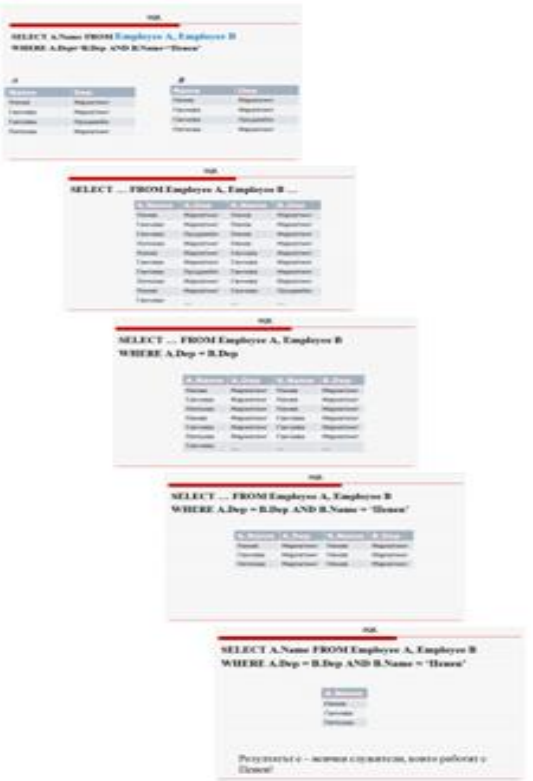

Figure1 Performance of SQL statement, explained by animation on a Rower Point presentation slide

The presentations used in lectures could be prepared just as text and some drawings or pictures. The time for preparation of such presentation is the shortest. Animations are more attractive for the students, but the time for their preparation is much more. The most important for this type of presentations is that they attract the students' attention and explanations are easier for students to understand. That is why these presentations are more valuable from educational point of view.

- The second approach used is training by using multimedia computers connected in a computer network. Each student works on an individual computer equipped with network software and

individual assignments, and on the computer of the trainer is installed control software, by the help of which the trainer is able to monitor the implementation of projects and to set new tasks and issues to the learners. This method is suitable for exercises, tests, controls or individual assignments. In this approach, students are constantly connected to the Internet and have full access to various educational materials and resources in teaching, it could be argued that it is more perspective and promising in modern education [11,12].
Different software decisions for realization of this approach are recognized – Moodle, Microsoft Class Server etc. They have different possibilities and the educational institutions could choose from them according to their manner of leading the learning process. Some of these educational institutions use authoring systems [9] or have their own software developments. An example of this approach using different type of applications is to be seen on fig.2 and fig. 3.

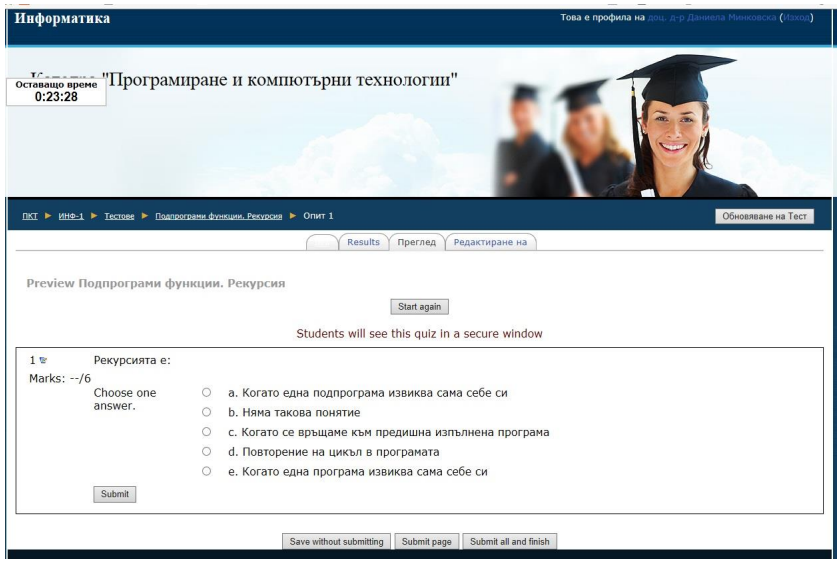

Figure 2 Screen from a test in the Moodle

The Power Point presentations might also be used for training purposes and especially for self-training. The idea is to make interactive presentations (fig.4) using Hypertext. The shown presentation is a lecture with the ability for movement inside the presentation. Such lectures may be used for lecturing but also for self-preparation of the students. In this manner not only lectures but also exercises can be composed. The simplest way is to put multiple-choice questions. The proposed answers should be Hyperlinks. The hyperlink for the correct answer will be the next question and for the wrong or partially correct answers – hyperlinks to additional explanations and after that again to the same question or to another question belonging to the same part of the material.

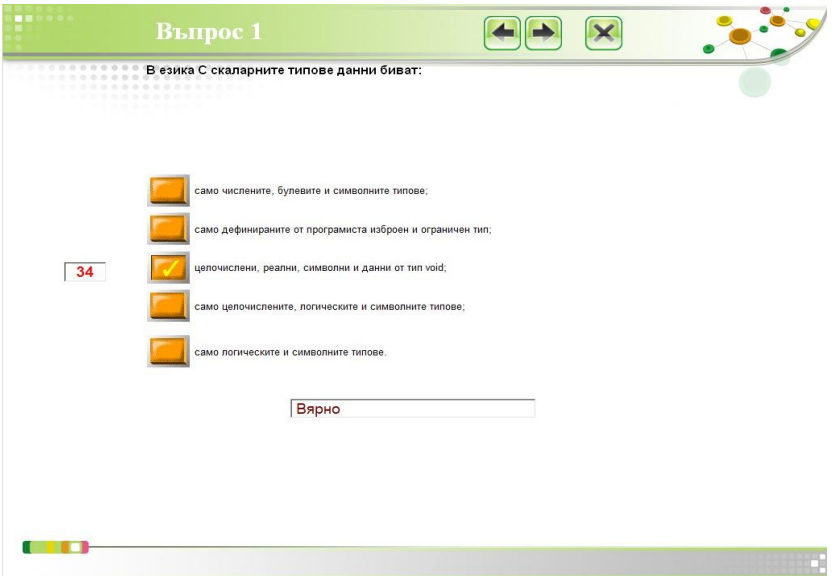

Figure 3 Screen from a test in Authoring system – ToolBook

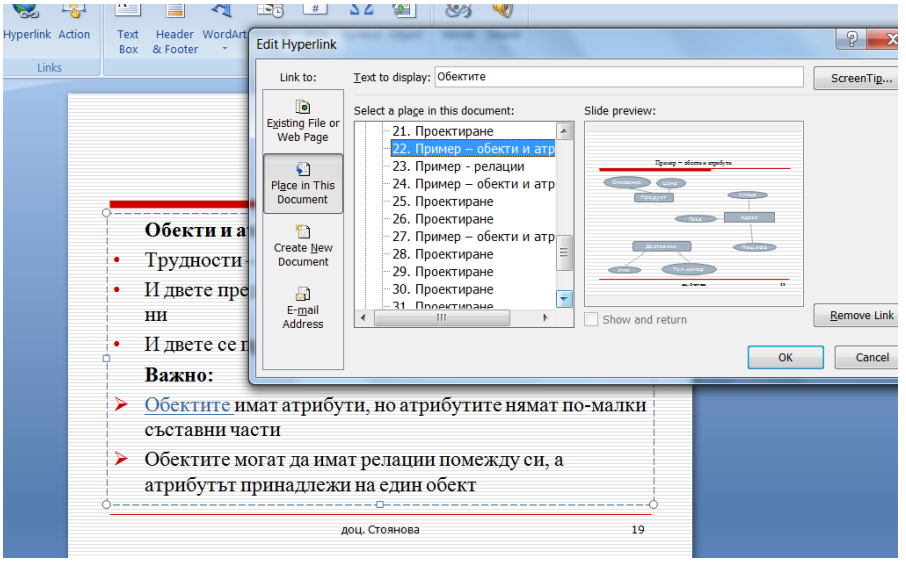

Figure 4 An interactive Power Point presentation with Hypertext connections within the slides

Multimedia technologies are widely used in the educational process in many engineering disciplines. Integration of various specialized products such as CAD / CAM systems, Photoshop, CorelDraw etc., which have the possibilities of multimedia, allow students to make better and more informed decisions leading to less change in the development plan [3].

4. The future of the Multimedia usage in the engineering education

The trends in using multimedia in engineering education are associated with more extensive use of [4]:

- multimedia databases where by using the database search engine a variety of information could be accessed. The databases might be in the form of catalogs, dictionaries, encyclopedias, reference books, etc.
- multimedia expert systems that allow the interpretation of data, the structural analysis and configuration of complex objects, planning sequences of actions and others. Multimedia expert systems usually solve problems by using heuristic or approximate methods, using knowledge of assessment and formal knowledge of established theories [5].
- multimedia simulation - complex technical systems are being simulated. The study of such simulations has been provided by a high degree of interactivity. This allows the objects and the processes to be studied not only externally but also from "inside." The future engineers have the opportunity to solve problems in a realistic environment very close to the real world and to explore how a situation affects the other (or another) objects. There are many opportunities to provide rich illustrative material (audiovisual examples of dynamic processes, objects, events and operations) for repeated observation (slow, fast, and in reverse order), the use of computer simulation of processes and phenomena.
- virtual reality – this is a set of computer-aided three-dimensional model of reality that creates a feeling of human presence in it. It allows the interaction between the objects, changing their shape and movement in the virtual space [6]. This is a technology that allows a user to interact with computer-simulated environment that may present scenes both real and fictional of (imaginary) world [7]. The design of an item using multimedia may be taken, cataloged and arranged in a controlled environment with all requirements. Using methods and techniques implemented in a virtual environment for designing, prototyping, validation and verification of elements based on virtual reality is the foundation of virtual engineering. Virtual prototypes of elements are made, which placed in the environment of virtual reality are tested [8].
- Augmented Reality (AR) – these are systems that work with markers, they are the today extension of the virtual reality technology. The AR elements are supplement of computer generated sensors data such as sound, video, graphic or GPS data. The increase is conditional in real time, for example supplement of computer vision or object recognition. The information and objects can be augmented over the real world [13].

5. Conclusion

The usage of multimedia has become very wide in the engineering education. Of course, there are still lecturers that prefer to use the blackboard and chalk or the whiteboard and marker especially for concrete explanations. And of course they have their reasons for that. One of the main reasons is that during the explanation the steps that the lecturer makes in the drawings on the blackboard make it more understandable for the students. This is true. Nevertheless, it is also true that during that time a part of the students loses their attention and that the drawings on the blackboard are never the same quality.

The most of the lecturers and in particular the new generation lecturers are strongly willing to use the multimedia tools and methods for presentation of the educational material. Using all the variety of possibilities of multimedia the use the blackboard and chalk can not only fully substitute the old manner of explanations but also even make them better. The preparation of multimedia lectures, seminars and lab exercises is not easy. First, it takes a lot of time. Moreover, it is true that the more time it takes for preparation of the multimedia materials so better are these materials. It is obvious that the multimedia has the possibility strongly to attract the students' attention and make the study material easier to understand. So the multimedia materials in education are the obvious future.

The usage of multimedia testing in the engineering education has been analyzed in detail at the Technical University and the students have shown their positive attitude towards this kind of testing technology in their answers in the inquiry [14].

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