

PEDAGOGICAL ASPECTS OF E-TEXTBOOKS

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***Summary** - Primarily, this paper deals with the observations saying that educational sciences are facing an important task to constitute a new school theory, enriched by pedagogical analysis of computer-based teaching. The paper underlines that schools have not been prepared to face the challenges of the increasingly fast development of ICTs and new media in education. Massive use of computers and Internet helped develop a new educational technique, this of e-education. The paper discusses flexibility of this form of education as beneficiary to classical forms of education.*

Further on, the paper examines the pedagogical function of e-textbook. The development of e-textbook is often related to programmed textbook. Issues that have been emphasized in the paper are possibilities to reach optimal individualization and to encourage discovery learning based on students' own activities, as well as advantages of this medium use. It has been shown that it is necessary to establish a systematic approach for the conceptual design of an e-textbook and also to determine sound pedagogical bases for its didactical design.

Key words: *Computer-based instruction, E-textbook, Media in education.*

Introduction

In the last few decades, criticism of traditional instruction has been dominantly present in our pedagogical literature. In different ways the authors have been trying to indicate that technology for producing students' knowledge is out of date. They have appealed to the researchers, theorists, and practitioners to understand that modernization of teaching/learning methods is the basic need of the society. The results of International evaluation of students' achievements (2003, PISA) rang the alarm bell for quality education. Productive and functional knowledge have become the imperative for education. Increasing development of educational technologies and the force of new media into

education both contributed to the development of new methods of learning and teaching.

Computer media significantly helped to depersonalize communication between people. However, they are attributed with numerous advantages, particularly with the ability that students can choose to learn in time and pace of their own. Despite the rapid growth of e-education, it seems that traditional concept of education shall still live. In this period of transition, electronic textbook is the first modern media to introduce students in an organized way into the world of e-education. This new model of textbook, with its flexible didactics apparatus, brings many advantages in comparison with classic, print textbook. Contemporary e-textbook design has the power to support the individualization of learning process. When it uses common ways of expression, such as speech, text, still and motion pictures, film, virtual reality, etc., and when it is designed according to the pedagogical conceptions of instruction, electronic textbook may well become a significant factor for quality technology-based instruction.

Pedagogical dimensions of computer-based instruction

In the context of contemporary education, traditional definition referring to systematic and simultaneous process of acquiring knowledge, skills, and habits, is inevitably being redefined and amended by media education, related to the process of teaching/learning by the use of modern means of communication and expression. Media education is a broad idea that has to do with media competence, which, above all, includes fast access to information, their selection, analysis, evaluation and application. Encouraging and developing critical use of media as means of expression represent the essential and basic task for contemporary school. Media literacy (media-based information and communication skill) has become one of the crucial goals in education. According to Convention on the Rights of the Child (1990) children have the right to ask, receive and disseminate information and ideas of all kinds. In this sense, the signatory countries have promised to encourage mass media communication because of dissemination of information intended for social and moral benefit of children. The signatories are additionally obliged to establish the rules to protect children from information and other materials that may have negative impact and cause damage.

In his book *Humane School*, after a detailed analysis of the then German school, Harmut Von Hentig (1997) brilliantly presented his vision of new, humane school. The bothering fact is that this text, so challenging for pedagogy experts, based on the author's experience and thinking during twenty years (the original text was written in 1993) is so much of current interest and relevance today. Respectively, school has not yet become a life environment

where one can gain experience, but rather environment where one acquires poor functional knowledge. “It often spends, if you include university studies, almost twenty years of life, one half of the following forty years of man’s working period. It does not gulp down children, but rather their childhood and youth“ (Hentig, 2007, 8).

Schools have not understood the significant changes that began with computers. If we want to have a reformed school, then we have to deal with computer as one of the key change elements. Computer should be approached to not as a mere technical device, but according to pedagogical principles such as individualisation, social learning through play, inquiry-based learning and doing, and complete instruction. In the context of applying computers in instruction, knowledge is being transformed into heaps; it is being equated with information and quantified. According to Hentig, when knowledge is reduced to loadable and transferable information that consists of the smallest units that can be distinguished (bit), then computer separates the character of a sentence from knowledge and understanding. Computers should not have a decisive and crucial life function in childhood. In other words, school should but provide thorough experience to children in order to make it and survive in the culture and society (physical, sensual, intellectual, esthetical, political, moral experience, etc.). Perhaps, the greatest challenge to pedagogy is the fact that computer limits students’ motion tying them to screen and keyboard, as well as to questions and answers within the used programme. “Computer culture requires something that does not come from work with computers, something we tend to forget: capacity for philosophy doubts, power to act morally, readiness to be politically responsible” (Hentig, 2007, 68).

Advocates of computer-assisted instruction support the idea that adequate teaching material (software) can contribute to individualized instruction. In this sense, computer offers many possibilities to search different information that favours fast progressing children. On the other hand, it can offer additional help to children with learning difficulties. However, researchers into contemporary media, especially sociologists, share different findings. It is true that modern techniques save time and increase efficiency. However, the spectacular entrance of Internet into the lives of young people (in the beginning of the 90’s) produced an even greater contra-effect – lack of freedom from information, and gaps that are fulfilled with fast, instead of slow time (Eriksen, 2003).

At California State University (Northridge) an experimental design was carried out during 1996 intended to examine the effects of virtual versus traditional class format on student performance in Social statistics. Students (33) were randomly divided into two groups, one taught in a traditional classroom and the other taught virtually on the World Wide Web. Lectures, tests and exams were standardized between the conditions. Prior to introduction of the experimental factor pre-test comparisons were made between these two groups

in age, sex, ethnicity, years in school, grade point average, or familiarity with computers and mathematics. The results indicate no significant differences appeared in any of the demographic or experiential variables. Post-test results that followed the completion of both virtual and traditional instruction indicate that virtual class scored an average of 20% higher than the traditional class. The results also indicate that virtual class showed significantly better understanding of the course contents, perception of more flexibility and greater effect toward mathematics, at semester end, than did the traditional class. Besides this, the results indicate that virtual class students show higher perceived peer contact (Schutte, 1996). This research has showed the importance of research into pedagogical dimensions for virtual teaching. Namely, the hypothesis that the lack of face-to-face teacher-student interaction will bring better results in virtual student-student interaction has been proved. Although differences in achieved test scores could be attributed to technology itself, it seems interesting that the highest performing students in both groups reported the most peer interaction. From this point of view, it is important to pay attention to the issue of collaboration, whether carried from within the traditional classroom or in the context of virtual space.

UNESCO Report for Education for the 21st Century clearly states that education has to be the core of new humanism, which anticipates that facts should be examined in real context and a critical relation towards information and media. Real understanding of events surpasses media presentations of these events, which sometimes tend to be oversimplified, or twisted (1997). The development of informatics society points towards increased access to facts and information, therefore it is necessary that schools prepare their students for changes in society and to train them to collect, select, evaluate and use information properly. We could conclude that as early as in lower elementary school grades children have to become familiar with the influence technology has on the development of society, as well as with the nature of e-media, their function and role in contemporary life.

From programmed to electronic textbook

Technologization of teaching and the development of e-media caused the need that all textual media used in class (particularly textbooks) be redefined. The textbook is no longer seen as a unique source of knowledge, but rather as a complementary source within a multimedia package. Faults of printed textbooks arise from defects of traditional school. Students' needs, interests, and abilities were neglected, the syndrome of boredom was intensively developed, and knowledge was not integrated but acquired partially, etc. Programmed instruction represents the first in a sequence of innovations that has managed to find the mechanism which helps individualise the teaching process. On the

other hand, it has been thought that this type of teaching jeopardizes the favourable effects of live communication in the class. "Today, when most children can access Internet, programmed learning and programmed instruction (principally programmed textbook or teaching material) are regaining their full sense in the light of electronic media" (Španović, 2008, 109).

Adequate programmes designed for computer-based learning can be realized by the use of the programmed textbook. Some decades ago its power was not questioned at all. The idea about programmed instruction was initiated by B. F. Skinner (1954). His starting point was the experience about Pressey's teaching machine. The only function of that machine was to test knowledge. In his paper titled "*The Science of Learning and the Art of Teaching*" Skinner criticized traditional instruction in schools and established a new teaching strategy based on programmed materials and textbooks. The essence of this theory lies in the following: learners are familiar with teaching contents; they are expected to solve tasks attributed to these contents and to check the responses. Skinner's linear "step-by-step" programme was improved by N. A. Crowder, who advocated intrinsic or branching programme. USA and many European countries witnessed a wide-spread use of programmed textbooks during the 60s in the 20th century.

Programmed instruction has greatly imperilled and violated the organization model of traditional teaching. Therefore, in the context of understanding advantages of e-textbook, the programmed textbook is of significant relevance. Planned and rationally guided teaching process represents the basis for didactic tailoring of programmed instruction. The programme students communicate with is being taken on by heuristic guidance. The programme has a continuous control over the learning process of every individual student; for every good reaction students get a reward, and in case of poor reaction there are no rewards. Cognitive path is broken down into small steps (frames) that obligatorily include information, task and feedback. When the task in the frame is so given to stimulate cognitive activities of students, it is then possible to enhance their curiosity, which is the presumption of innovative approaches to teaching and learning.

Design principles for branching programmes may directly be integrated into the process of e-textbook design. From one step to the next step lead different branched paths. Each answer to the assigned question displays a page number leading to the next step in studying the subject matter. Correct solutions are followed by new information (new knowledge frames), while incorrect responses direct students to look for additional explanations. There is not a single student who will pass through all pages of intrinsic programme without skipping any of them, since it is very much unlikely that a normal student will but solve all tasks in his final attempt, respectively after he had chosen all wrong answers (Bakovljević, 1992).

The very limited number of studies about the successful application of programmed instruction with the use of contemporary media is available in didactics literature. It is possible to store programmed textbooks designed for a particular course into database, so that they are available for students to use them either in a classroom environment (managed by a teacher) or at home. This way helps students to master the subject matter gradually, unit by unit, and when help needed, they can communicate with the programme with integrated feedback. Although computer-assisted instruction has been thought to be the most developed variant of programmed instruction, there is an ongoing process of constituting pedagogical knowledge on the electronic textbook and other types of educational software (however this knowledge has not been well systematized, yet).

New media-supported environment offers new models of teaching and learning. Educational technology, i.e. technology of education, the term frequently used in this paper, has been adopted from material production. It means integration of scientific knowledge that contributes to efficient, productive, rational and economical education. Media didactics has been constituted as a discipline that studies preparation, design, and possible applicative uses of different media in teaching/learning. Among various expressions denoting the use of contemporary teaching aids, the term "media" has its place, too. "All objects and individuals that can carry information and mediate in educational communication could be assigned to the term of educational media (Matijević, 2000, 25).

Due to terminology differences and interdisciplinary character of research on e-textbook as a new educational media, although affirmative, common opinion about electronic textbooks is too general, unclear or imprecise. Today we know that such textbooks can provide students with fast information through different media, followed by a variety of document presentations (museums, exhibition rooms, etc.) or multimedia databases on different topics.

Before computers were integrated into classrooms, the basic media in the process of education were school or university print textbooks. Outcomes of the previous research studies into electronic media indicated that the textbook represented a model for computer-based education. E. Schwarz, P. Brusilovsky and G. Weber (1996) proved and claimed that then electronic textbook was but a true copy of the print textbook. Today, electronic textbooks are much more developed and therefore much better than the precursors, because the structure of traditional print textbook has been enriched by two important characteristics: interactivity and intelligence. First electronic textbooks included presentations of texts only, and then graphs were added. Personal computers have made them available to public, while multimedia technologies provided presentation of sound, picture and animation. Research on computer use for education has showed they can be more advantageous media for learning (Španović, 2008).

It is well known that certain fields cannot be studied by the use of electronics only. Therefore, today we recommend the integrated teaching-studying-learning system, which is a combination of classical school instruction and Internet based instruction. Similarly, due both to certain e-learning defects and to the lack of appropriate e-textbooks that could satisfy different needs of users, programmes and schools, it is quite obvious that we cannot (and must not) neglect the role of a didactically up-date printed textbook. (Španović and Đukić, 2006, 360).

Educational – didactics aspects of information design in electronic textbook

Internet caused great changes in human communication, both in the communication between people and in their communication with different sources of information and various types of media. Application of electronic media has had great impact on redefining traditional roles of both teachers and students, as subjects in educational process. When students are concerned, the focus is on individual activity accompanied by high cognitive activities. On the other hand, the teacher is more and more in charge of organizing student's learning process (individual knowledge acquisition). Today, the crucial role of a teacher is to train students how to use electronic media, since in many learning environments media has become individual or group instructor (one that helps). In order to make electronic textbook be usable media in education for potential course learners, e-textbook expert designers must consider the following issues:

- Is it a single knowledge source or the part of multimedia package?
- Is the media used in teacher's instruction (and to which extent)?
- For which education level is the media intended?
- What instructional tasks should be covered by the media?
- What is the mental condition of potential media users?
- What is relevant experience of the potential users? (Matijević, 2000, 29).

After the above mentioned issues are optimally considered and agreed by an expert team, the learning contents of a particular subject (course) are didactically structured. This procedure follows the same sequence as in print textbooks. The dimension of knowledge is appropriately adjusted in both extensity and intensity, specialized terminology is introduced, steps in delivery measured, contents are visualized, orientation and acquisition apparatus (productive tasks) prepared, and so on. Compared to traditional textbook, the advantages of electronic textbook lie in the fact that they can store different texts and didactic materials (films, charts, graphs, photographs, etc.), prepared

by the authors' team. "The greatest advantage of electronic textbook is that it supports interactive simulation to show a process, which cannot be easily seen at any moment in our immediate natural surroundings" (Španović, 2008, 115).

Tailoring information to fit the electronic textbook is crucial to learning process. The producers of electronic textbooks very well understand that creating information requires a multidisciplinary approach and depends on numerous considerations. The complicated language of texts, photographs, and graphical design may affect the clear understanding of the anticipated message. Thus, the message that is being sent must be carefully worked out in details, and, on the other hand, correctly interpreted and understood by the receiver (clear communication). According to Pettersen (Pettersen, 1998), the context in which the message is presented is crucial to the way it will be accepted. When context includes text, speech, music, and visual effects, our attention will be directed to sound or picture. Text reading, looking at pictures or active listening is directly dependant on the capacity of our short-term memory. We may have difficulties to understand complex words or sentences, and they can hardly be placed into a meaningful context. When speaking about memory, people often refer to long-term memory. In order to place new information into a long-term memory, we have to think it over and to manipulate it. In this context, if learning is to occur, we have to be interested, eager and ready to learn. When media are used as learning device, our attention remains open for information that are being processed and thus integrated into our system of previous knowledge and experience. In the next step we apply the information and test to confirm them.

If electronic textbook "involve" a student into the learning process in the way that he/she is able to give his/her own examples about a topic, if he/she can check the accuracy of his solutions, if he/she can pose new problems, and is aware of errors he/she has made and similar, then we speak about the interactive student. However, if the textbook includes usual activities performed by the teacher, then we speak about the intelligent textbook. These aspects of electronic textbook have been studied within the ITS domain (Intelligent Tutoring Systems). The existing ITSs for learning programming for example, provide students with a possibility to make intelligent analyses of separate steps that follow the problem solving process. Besides, individual learning paths are created and tailored to answer the needs of each individual student, which means that every student is free to choose his own pace, examples and problems (Schwarz, Brusilovsky and Weber, 1996).

We support the idea that guided exploratory learning, as a form of learning, be incorporated into electronic textbook. Therefore electronic textbook (which may have all hypertext characteristics) may be tailored as a specially prepared programmed material that can ensure cognitive activities of students who are guided by instructions designed by a team of authors. Certain suggestions in-

corporated into the education programme in the form of questions, comments, landmarks, and other didactics instructions, help students reach the goal in easier and faster manner. In doing so students easily find the way how to solve the problem, they will hardly stop at obstacles and will escape fall into possible traps during learning. We advocate the idea that in the process of investigating new knowledge, students need didactic-based help (guided teaching), which has been supported by a number of research studies into efficiency of early form of guided exploratory instruction.

R. Mayer (2004) criticizes pure exploratory learning approach in learning. He states that in the beginning of 1980s, a new arena had opened for examining effectiveness of various forms of learning by discovery, among which discovery of computer programming concepts. According to him, in his book *Mindstorms*, Papert (1980) argued that children should be allowed to engage in hands-on-discovery within a LOGO environment, without any guidance and curricular objectives. Kurland and Pea (1985) tested one group of students (11 and 12 year olds) who had more than 50 hours of LOGO programming experience by applying the method of pure discovery. The students were able to write and interpret short, simple programmes, but had much difficulty with programmes involving fundamental programming concepts. Fay and Mayer (1994) taught LOGO programming using either a pure discovery or a guided discovery approach. In the pure discovery method, students were given a LOGO manual and then engaged in creating several LOGO projects over four one-hour sessions. In the guided discovery method, students were given the same projects. Additionally, they were given explicit instructions about modelling of design concepts such as work of programmes, hints and feedback about how their programmes related to design principles (Mayer, 2004). On final tests, the researchers found that guided discovery group wrote more successful programmes, made better use of good designed principles, and solved planning tasks better than the pure discovery group.

In the light of guided learning, the authors of electronic textbooks (educational software) can offer their users the mechanism that continuously check how well they understand the curricular contents (discovery of errors in learning), and control the quality of their own knowledge. "If it is obvious from student's answers that he/she does not understand the curricular contents, either the sequence along with its contents should be repeated or a new sequence with additional explanations should be activated" (Danilović, 1997, 98).

New ways of learning based on e-technologies enable acquisition of knowledge based on the use of a personal computer. Such learning can be realized through educational materials delivered for computer-based instruction or through Internet instruction. According to Španović and Đukić (2006), only expert teams of high professionals have the capacity, mandate to design, and create valuable and efficient interactive learning materials and sources of

information. However, one of the open key questions has been the question of choice of an adequate evaluation paradigm, models, types, techniques and instruments for complex evaluation of software and processes, as well as e-learning outcomes. "Training students to become active participants and acquire knowledge in a virtual classroom might represent an important step forward towards life-long learning" (Španović and Đukić, 2007, 160).

Conclusions

It is obviously true that electronic textbooks have made a great progress since they appeared in the last decade of the 20th century. Internet and multimedia education software have caused a wide-spread development of distance education. Multimedia software (encyclopaedias, textbooks, etc.) have become the basic need of 21st century education. Although e-learning eliminates numerous traditional school faults, we tend to overlook certain issues related to this form of education. First of all, personal communication cannot be replaced by media communication. However, this controversy can be moderated when learners participate in chat-rooms and teleconferencing. The first complete study to emphasize the need for systematic approach in the design of educational software intended for classroom use is *Theoretic and Practical Approach to Educational Software Evaluation* by M. Đukić (2003). Besides advantages of computer-based learning, the also study states defects related to the devaluation of corrective component of instruction and the formative function of school.

However, it is not easy to understand the increasingly complex global events, to see facts within the framework of objective context and to think critically about means of information. This requires huge efforts in creating a strategy to train students for life-long learning. Computer-based instruction (including the use of e-textbook) surely provides for flexible individualized learning. It increases motivation and students' self-esteem because it helps them earn their knowledge. Nevertheless, the computer itself does not necessarily mean that the children will develop divergent thinking, creativity, collaboration, responsibility in decision making, democratic behaviour, etc. The priority task of educational sciences is to investigate ways to bring educational media under certain standards and to suggest criteria for their design, so as to make them carriers of society progress. Analysts estimate that electronic education will suffer great progress in future. When we look at computer-based instruction from the point of view of media and pedagogy, then we have to remind that inadequate use of computers may dehumanize schools and lead to unwanted consequences. It is of crucial importance that teachers are continually being trained to use (and evaluate) educational software and e-materials for learning, and that experts in different disciplines work out the methodology for didactics-based media design, design which should be recommended to and respected by e-media producers.

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PEDAGOŠKI ASPEKTI PRIMJENE ELEKTRONSKOG UDŽBENIKA

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Sažetak - U osnovi ovog rada je zapažanje da su obrazovne znanosti pred važnim zadatkom da konstituiraju novu teoriju škole, obogaćenu pedagoškom analizom primjene računala u nastavi. Ističe se da je škola nepripremljena za izazove koji su nastali brzim razvojem informacijskih tehnologija i novih medija u obrazovanju. Masovna primjena računala i Interneta doprinijela je razvijanju nove tehnike obrazovanja, e-obrazovanje. Fleksibilnost ovog vida obrazovanja se, u odnosu na klasične oblike edukacije, razmatra kao prednost.

U radu se, nadalje, analizira pedagoška funkcija elektronskog udžbenika. Nastanak e-udžbenika se dovodi u vezu s programiranim udžbenikom. Kao prednost korištenja ovog medija, naglašava se mogućnost optimalne individualizacije, te podsticanja učenja otkrivanjem vlastitom aktivnošću učenika. Ukazuje se na potrebu da se sustavno uredi koncepcija elektronskog udžbenika i da se utvrde pedagoške osnove za njegovo didaktičko oblikovanje.

Ključne reči: Nastava pomoću računala, Elektronski udžbenik, Mediji u obrazovanju