E-learning and Teaching - Methodological or Technological Problem

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Abstract

How to solve the educational problems of young generations of students (with the old kind of teacher)? In this article we will hand out the concrete activities, that will indicate solutions above for mentioned problem. Important is that we use methods which enable students to actively participate in educational process while acquiring skills necessary to function in tomorrow's world, especially tomorrow technological society. As we mentioned previous we will restrict our attention in this paper only on two of four pillars of educational system, namely only on the learning/teaching process and on the educational environment.

To produce high quality e-learning materials is not enough subject knowledge, but we need at least two areas of knowledge: ICT and the didactic field. The didactic field, which is crucial for making e-learning material, doesn't get enough attention. In the past there were variety of different didactic approaches developed, which would be useful even in a modern e-learning and teaching based lessons. One of these is also programmed instruction. The article will show how we can adapt existing theory with today's technological possibilities.

Keywords

E-learning materials. Programmed instruction. Didactic principles. ICT.

Introduction

E-learning and related e-learning materials are nowadays becoming increasingly used and desirable form of learning and teaching in the world and in Slovenia. In schools, teachers use and produce different e-learning materials, but they almost never deepen in the didactical features of such e-learning materials. Didactical features are the ones that make e-learning material in a way that they meet the main purpose, which is actively enhancing the quality of education and knowledge; e-material becomes e-learning material. In this article we will talk mainly about the latter. (Achtemeier, Morris and Finnegan, 2003)

The broadest definition of the e-material is the material that is sent to the user on an electronic medium. If we relied on the assumption that the modern electronic learning material is enabling active learning, that results from the individual's knowledge, it include formative and final verification by automatic feedback and thereby improve the quality of learning results and knowledge of learners, we need at least three profiles of experts and expertise for making such material (Ausubel, Novak and Hanesian, 1978):
Experts in the field of didactics, who are responsible for the designing of e-(learning / teaching) materials. In order to make the material suitable for use in the learning environment, we must always seek answers to questions:

- how people perceive information and how information may be provided;
- how people learn;
- what methods and didactic principles can be applied;

Experts in content that have a special professional knowledge and can answer questions:

- which contents are relevant, to which knowledge in a given field;
- how is this knowledge connected to the whole;
- what is the basic knowledge and what is an upgrade;

Experts in computer science or ICT to produce e-learning material to the standards and guidelines and to answer questions:

- how computer programs are built and how, on this basis the electronic learning materials can be built;
- what are the technological capabilities of use in education;
- which standards of electronic learning materials will fit to it;

When making e-learning materials it is also necessary to provide a methodological, technological and content suitability. The biggest problem of today's e-learning materials is the neglect of the methodological and consequently also the content area. Often there are the interactivity and multimedia and the final verification, the only didactic elements contained in e-learning material. (Aberšek and Poppov, 2004)

Didactical solutions to e-materials-based learning and teaching can be found in a number of existing methods of learning, one of them is also programmed instruction which was in the early seventies, emerged due to the rapid development of industry, science and technology and the need for a self-learning (Strmčnik 1978). The authors have carefully developed a didactic concept but did not have the technology with which it could be used effectively. By using their results and with today's technology we can produce effective e-learning material, which enables the active learning and enhance the quality of acquired knowledge. Over time some studies have suggested that programmed instruction is superior to conventional teaching (Chatterjee and Basu, 1987; Daniel and Murdoch, 1968; Fernald and Jordan, 1991; Kulik, Cohen, and Ebeling, 1980) while some others studies have indicated just the opposite (Kulik, Schwalb and Kulik, 1982; Bhushan and Sharma, 1975). Differences between studies are in design discrepancies. Several meta-analyses of a programmed instruction (Hartley, 1978; Kulik et al., 1980, 1982; McDonald, Yanchar, and Osguthorpe, 2005) have indicated that more recent studies have produced better results because more recent programming possibilities were used.

Technology enhanced learning

Technology enhanced learning (or TEL) refers to the support of any learning activity through technology. TEL is often used synonymously with E-Learning even though there are significant differences. The main difference between the two expressions is that TEL focuses on the technological support of any pedagogical approach that utilizes technology. However this is rarely presented as including print technology or the developments around libraries, books and journals in the centuries before computers. A learning activity can be described in terms of the:
Learning resources: creation, distribution, access, compilation, consumption of digital content; tools and services;

- actions: communication, collaboration, interaction with software tools;
- context: time, duration, surrounding people and location;
- roles: A learning activity is carried out by various actors in changing roles (e.g. student, teacher, facilitator, learning coach, human resource or education manager);
- learning objective: to support every human in achieving her or his learning goals, respecting individual as well as organizational learning preferences;

Learning activities can follow different pedagogical approaches and didactic concepts. The main focus in TEL is on the interplay between these activities and respective technologies. This can range from enabling access to and authoring of a learning resource to elaborate software systems managing (e.g. learning management system, learning content management systems, learning repositories, adaptive learning hypermedia systems, etc.) and managing (human resource management systems; tools for self-directed learning, etc.) the learning process of learners with technical means.

About the definition

The existing definitions for technology enhanced learning spread very broad and change continuously due to the dynamic nature of this evolving research field. Hence, the definition of TEL must be as broad and general as possible in order to capture all aspects. Technology enhanced learning (TEL) has the goal of providing socio-technical innovations (also improving efficiency and cost effectiveness) for learning practices, regarding individuals and organizations, independent of time, place and pace. The field of TEL therefore describes the support of any learning activity through technology.

Didactic concept

Nowadays it is probably the main methodological problem of e-materials their inability to adapt to the user’s needs and previous knowledge. The majority of e-learning materials which are produced today have the same scenario, content and objectives for all users regardless of their level of knowledge and diversity. What this material is missing and it is therefore imperative it is the individualization of e-materials. (Ausubel, Novak and Hanesian, 1978).

The answers of this methodological problem and how to apply the individualization in electronic learning materials can be found in the idea of programmed instruction.

Definition of programmed instruction

The tendency to effective teaching and self-learning devices can be traced from Socrates to the modern times, or as in 1963 Skinner wrote: "If by some miraculous invention we could edit the books so that the second page would be clear only to those which would master the first page, then it would be a big part of what is needed now to direct the activity of the teacher, students can learn themself. " (Skinner, 1963, p. 335).

The main characteristic of programmed instruction is that it enables self-training, because the function of transmission and consolidation of knowledge assume the computers (machine learning), either by special education programs or the teaching materials. They consist of the special psychological, didactic and technical programming standards which allow (Strmčnik, 1978):
careful analysis of the logical structure and basic concepts;
concentration of learning content around the main logical axis;
programming of learning paths;
work in the individual tempo and individualized programs (personal tempo),
gradual progression (step by step approach);
integration of unknown with the familiar and immediate self-control;
transfer of knowledge and skills directly to practice;

In the past the programmed instruction evolved in two directions:

- Behavioristic direction (learning as a function of human adaptation to the principle of stimulus and reaction) (Anderson, 2007);
- Cybernetic direction (the process of programming and management of teaching and learning as a pedagogical application of cybernetics to the field);

Since a pure behaviorism and cybernetics tend to different extremes it is best to avoid both, and define programmed instruction as only one of the methods of teaching and learning. Therefore programmed instruction is a learning method which allows through methodologically and technologically pre-defined and relevant teaching resources and tools, relative independent and individualized learning.

On this basis, the programmed instruction is only a part on teacher-based lesson, which does not exclude it but connect it. Programmed instruction should not be understood as a replacement for the teacher, teacher is still an indispensable part of the learning process, but as a learning method that relieves the teacher and allows division of work. We can agree with Skinner, when he says: "Learning machines are an excellent means to save teachers time and facilitate its work. If a teacher leaves the machine those learning features that can be mechanized, then is free of his irreplaceable human tasks in the learning process." (Skinner, 1958, p.63). In the flood of information and the growing packed schedules of students and teachers should be programmed instruction and its good basic features and principles applied in all levels of education.

Programmed instruction and individualization

The theoretical bases and the construction principles of the programmed lessons are subordinated to the consideration of the individual differences among students. The set goal was to achieve a complete individualization with the help of the programmed lessons (Newel, 1990).

The programmed lesson offers, besides the theory of learning steps, also four principles, guides for individualization:

- Individualization of personal tempo;
- Individualization of learning content;
- Individualization of learning methodology;
- Individualization of learning assistance;

The theory of short learning steps of programmed lessons results from reality because the comprehensiveness of the students is very different and therefore it seeks for possibilities also for poorer students to understand the learning content. Therefore different approaches can be used:

- linear program or
- branched program.
The linear programs that allow students to progress no matter the mistakes he or she makes or it sends the student back to the starting point, they don’t contribute to better understanding and motivation. Far better are the branched programs where the student can’t progress before he or she does not answer the question correctly. The mistake is than discovered by him-herself individually with comparison of his-her answer with the correct one or what is even better with the help of additional information or suggestions. This way we enable the student to study the mistake thoroughly and so the non-stimulative mistake is changes into satisfaction that he-she recognized the mistake and corrected alone. (Gerlič, 2011).

The personal tempo or we can also call it the learning tempo is by each individual different. It depends on the pre-knowledge of an individual, his-her motivation, learning habits, understanding of the content and what is most important from his-her capabilities of thinking in dependence of the process complexity (Blažič and others, 2003).

The technique of the branch programming enables much more varied individualization of the learning content. It offers to the students more additional side ways with additional information that enable them to overcome a specific barriers on the main learning path or to broaden the knowledge of this path.

The individualization of the learning methods, forms and techniques has been until today known as notable principle in the present electronic learning materials. At the beginning of programming the lessons there were no possibilities to add the interactive and multimedia elements. Today we cannot imagine the electronic teaching material without pictures, sound, animation and movies. But we have to stress that by the linear programming of electronic learning materials the use of these elements is not as expressive as by the branch programming. The essence of the individualization of the learning methods is in the act when we offer the students the alternative learning sources and tools and not offering them a little bit of everything (Myers, 1995).

The last dimension of the individualised programmed lesson is the individualisation of the immediate learning assistance. This individualization has proved to be the most difficult at the beginning of the programming of lessons and is as such today. It remains an eternal question how to assure the students a learning assistance when he-she is in trouble. It is true that with a good programming, appropriate instructions, suggestions, impulses, encouragements and additional clarifications, we can avoid most of the problems, however some individuals or groups can encounter the unexpected difficulties.

The experts view of that time were about this different. Some believed that the machines will in the short time be able to offer direct assistance to every student at any time. This kind of assistance is presently not possible. The progress of artificial intelligence and also the availability of this technology in the educational process is at the very beginning. Therefore we can join the others who claim that the direction to the individualisation of the learning assistance is hidden in the good programming of the e-materials. With testing and proving we can avoid most of the problems that can be accoutred by the students, whereas most of the bigger unsolved problems can than be solved only by the teacher. The programmed program can enable the student that he-she can repeat over and over again and try to solve the problem but he-she cannot independently discover his-her weak points. The concrete or personal assistance of the teacher is still his-her greatest advantage.

**Guidelines for the modern e-learning material**

Taking into account the present situation and the desire to manufacture modern electronic learning materials, which would allow an effective and independent learning, we should strictly
follow the described methodological characteristics of programmed instruction. This would avoid the situation where the majority of electronic learning materials is only mapping the textbooks with added interactivity and multimedia elements.

In modern electronic learning materials, we must take care that there is appropriate hierarchy established (Figure 1). Learning whole is composed of several learning units and these are composed from different building blocks.

![Diagram](image1.png)

**Figure 1: Learning whole**

The building block (Figure 2) is a basic and essential element that affects the quality of e-learning material.

![Diagram](image2.png)

**Figure 2: Building block**

It must have an appropriate branched learning steps (Figure 3) that:

- should not be fragmented but connected to previous and the following learning steps;
- must be adapted to individual needs, level of knowledge and abilities of students;
- should include regular checks with feedback that guide the students from beginning to end of each learning step;
This is the only way that a student can understand and comprehend the chain of building blocks in the final whole.

With construction of such building blocks and, consequently, learning units, we could ensure that the learning unit will contain several building blocks with several different operational objectives. Taking into account the target hierarchy, the learning unit can also have its own intermediate learning objective. The learning unit should be complemented just with appropriate diagnostic check, which would include sets of tasks from summative checks of building blocks. Set of multiple learning units can be combined into learning whole, which becomes right and rounded representation of electronic learning content.

**Conclusion**

Information Communication Technology (ICT) has already an integral part of the school system in Slovenia. E-learning and e-learning materials are concepts, without which the education nowadays is no longer imaginable. Therefore it is so important that the e-learning materials are skillfully manufactured to serve to supplement teaching and are intended for active teaching by emphasizing the possibility of self-study and independent student activity, but not to have an end in itself, as often happens.

Mapping a content from schoolbooks with added multimedia and interactive elements should not satisfy us. Such production of electronic learning materials is otherwise the fast, easy and inexpensive, but it can not be said that this is training material and such material certainly does not belong to school. Electronic material is a learning material only when allows an individual to come to
the desired objective on the path which corresponds to it, allows a gradual progression, and their own personal tempo, equally such material should not allow an individual with no knowledge or insufficient knowledge to progresses. Manufacturing of electronic learning materials requires different skills and profiles of experts, requires individualization and differentiation of individual participants and ongoing checks, that does not serve for evaluation but for guiding an individual within relevant path. As shown in the article, this quality is achieved by using the theory of programmed instruction.

Department of technical education, Faculty of natural sciences and mathematics, University of Maribor is preparing an extensive research designed to measure the effectiveness of programmed instruction and analyze its advantages over traditional teaching. For the research e-learning material will be used, which will have a branched structure that allows individual, independent and effective learning.

References


