CREATION OF EDUCATION ACTIVITIES MODELS WITH E-LEARNING SUPPORT

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Abstract

Education and possible further studies have become a rather demanding investment. At the time of imperfect technology, i.e. technology of the previous period, it was a very difficult and doubtable task. But, is an ordinary use of new technologies a formula for the solution? We shall try to adequately answer this question. In our contribution we shall introduce educational activities (e-courses) based on cooperation and experimentation within the combined form of education. The aim of the paper is to describe possibilities of using the known methods of modelling of systems, such as modelling with the support of Petri nets and modelling technologies known from the sphere of engineering cybernetics. We shall describe possibilities of creation of a model of educational activity and in conclusion we shall attempt at assessing the educational e-activities in the context of qualitative aspects of the combined education with the support of e-learning based on ISO standard.
Key words: *e-learning, e-course, models of learning activities, Model of Petri nets, Adaptive hypermedia systems, standard of evaluation ISO 9126*.

Introduction

Very significant for the main persons involved and implementors of technological possibilities of information flows is the environs, in which these flows exist, and in what form the required information is transferred. Good quality academic education is based on the transfer of information in such amount and quality as it is allowed by the current ICT (information and communication technologies). The decisive role is played by the methods of modelling and simulation of processes and activities in the sphere of education. These represent mainly the design and creation of models of educational environs and description of methods of information transfer in the designed models. Thus, in the defined information and scientific models the knowledge is transferred from professionals (teachers) to those, who are being educated (students) in the form of lectures and text-books. We have a good case that the increasing impact on further education by means of impressive tools based on ICT has a ponderable effect on increasing the quality of education and in any way also on reducing the costs of education. We can support the fact that new low-cost educational models with the support of e-learning, which are based on constructivism, can be used parallely with traditional forms of education as combined (or extensive) training approaches. In such a combined environs, organization and technological issues, which form an inseparable part of the educational system should be considered one unit, along with the contents of education.

Quality and success of the e-learning support of studies do not rest in the quantity of designed courses (usually en masse filled into the given template). Success of the e-learning support of study requires a systematic planning, formation of a design, evaluation and putting

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the system into the practice, in which training is actively supported and stimulated. In order that the e-learning system was successful, it must have a feel for all participating components, including learners, teachers, supporting personnel and the institution as well.

In the course of the past few years, within the projects solved at the Department of Informatics we have obtained the prerequisites for a successful implementation of instruction with an e-learning support as part of the combined form of studies. In the initial phases procedures were elaborated, using which a lot of e-learning courses were designed. These courses have already been implemented into training and have become an important part of external forms of study, but also a support material for daily forms of education in the field of Applied Informatics.

Designing the Model of Teaching for an Educating Subject

In the stage of development and formation of the model of teaching the structure of the instruction management programme is important. From the point of view of sources and genesis of the model of the teaching subject we differentiate two categories of model origination:

A priory model of the subject of education is given by a set of potential knowledge on the studying individual, or population at the moment of entry into the training process.

Procedural model of the subject and his instruction is defined by information on how the subject behaves in the process of education and recognition, and what is the gradual and terminal success. This dynamic projection of input factors becomes the base not only for permanently innovated model of the subject, but also the base for the model of instruction and its management.

Another significant step in the process of searching for and utilization of the model of teaching is its expression, form of description. The requirement, which resulted from the potential application of other approaches to the modelling of the controlled instruction, was to design a plan of education with regard to the contents in question, structure of the given topic, etc. By implication from this teaching plan, a project of training activities, selection of observed and affected parameters of education for the given subject being educated, selection of information, teaching tasks, form and placement of feedback information, control of the course and result of education, of which creation of a storage site for data on the subject for the personalization of education based on the designed model of controlled teaching, should originate.

In the environs of a classical instruction of academic character, controlling the education is carried out by the lecturer himself and in case of the forms of instruction using ICT and the support by e-learning – the academic tutor, or this function is partly taken over by the management system – LMS, the results of which in the process of teaching the student within an e-course is watched just by the tutor, who evaluates the results of the study using the LMS evaluation.

All models of teaching management should express a unified notion of how the teaching of the subject should be initiated and regulated, how to organize its conditions in order that it be effective in reaching pedagogical and psychological objectives. Ultimately, they should be, first of all, bound to the model of the subject and the model of teaching, as they are projected into the teaching plan (Kulič, 1992).

Designing and Creation of the Model of Blended Form of Education Using Petri Nets

An advantage of modelling the teaching processes using Petri nets is their formal description, which complements the visual graphic representation. Thus, a precise and exact specification of the process is allowed and it is then possible to avoid ambiguities, vagueness

and contradictions. Besides the visual graphic representation, Petri nets have well defined mathematic bases, which can be used in various software tools for the specification and analysis of computer-solved corporate processes. For the description of teaching processes, such as passing through the study material in an e-learning education, it is suitable to use mathematic and graphic methods, where serial machines are mostly used, which show, however, certain limitations. These issues can be suitably solved using Petri nets, for their precise and exact specification. For extensive teaching materials, where bonds between individual activities can be described only partly, it is advantageous to implement fuzzy logics into the classical Petri nets (Klimeš & Balogh, 2005).

Methodology of Modelling the Teaching Programmes

As to how binding the individual steps sequences are for the student, we differentiate two main types of teaching programmes: linear and branch ones.

Linear teaching programmes dictate for all students a strict and binding sequence of steps in a single line. Contents of education is studied in small amounts of information, however, the best is to study one of the information in each step only. The designed notion is practiced as to the need, until the student masters it. Adding one notion to another, the student gets acquainted with the whole theme and its issues. Opponents of linear programmes state that very small steps interrupt, in an undesirable way, the trains of thought of the student. As to the practical experience, linear programming is suitable for teaching basics and principles of the problem and also for the formation of the word-stock and new concepts.

Branch teaching programmes are susceptible of varied procedures when solving problems. Alternatives of „branches" of the programme finally lead to the successful coping with the problem, however, each student takes the line, while its length corresponds to his personality, knowledge and gift. When teaching facts, a certain main line is visible in the programme, out of which various formed side lines evert and reintegrate. The main line usually allows for proceeding in wider and more demanding steps, which can be mastered only by a gifted student, answering adequately to the inserted control questions. Shorter and easier steps for less gifted individuals and slowly working students takes place in secondary lines (Klimeš & Balogh, 2005).

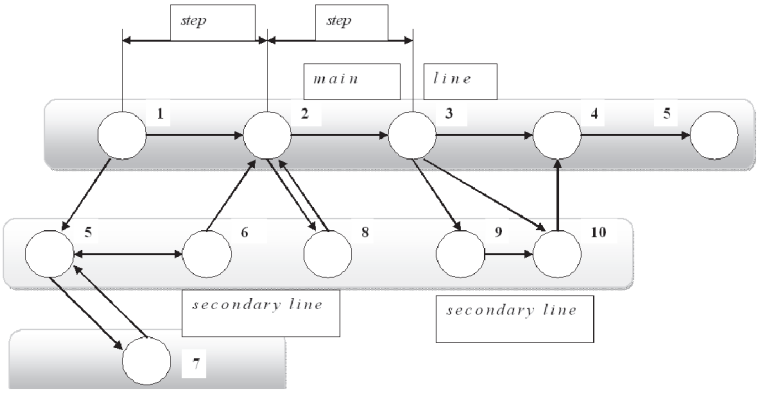

Figure 1. Diagram of a branch programme with a single main line.

Larger information contents of individual steps upon branch programme allows its activation and the student is sometimes amused by the form of a dialogue. Branch programmes are especially suitable for the provision and manipulation with new concepts. Their basic benefit is that they allow the student to choose, upon studying the study material, the individual line, which corresponds to his intellect and previous knowledge.

Each of these basic types of programmes has also further variants, according to the fact whether the student creates or selects the answers to the control questions out of the provided variants of answers.

Model of an E-learning Course

The aim of the whole modelling of the e-learning course, its purpose and at the same time the expected (marked) benefit, is shortening of the sequence and increasing the visualisation of teaching operating systems, which has the consequence in increasing the knowledge level of students and raising the level of seminar papers and diploma works of university students in the sphere of Operating systems.

For the modelling of an e-learning course we had to choose a suitable software means, which would have reflected our needs and that is why we used the programme HPSim, which is free of charge (freeware) for research and educating purposes. Its merits are easy installation, simple control and excellent possibility of simulation (parallel processes). HPSim allows for modelling using P/T Petri nets with inhibitors and test rims (Markl, 2003).

When designing the structure of the electronic course we took into account the following principles of self-study: to clearly define the aims of the course as well as individual chapters; simple and understandable style of writing; transparent structure of the test in individual logical units; visualization; support of the self-study in the form of direct teaching, discussion groups, etc.

When designing the course itself we reflected all aspects of creation of e-courses (Turčáni & Nagyová, 2008). A correct e-learning course should include the following fundamental parts for the creation of explanatory part of e-materials: introduction; study objectives; time schedule and a guide to the study materials; the explanatory text itself complemented with the resolved exercises, screening questions, tests, etc.; correspondence tasks; summary; final tests; glossary of terms; bibliography, important references, annexes, etc.

Draft of a Cybernetic Model of Controlled Teaching of a Combined Form of Instruction

With a certain approximation, the controlled teaching system can be considered a discrete dynamic system, for the description and expression of which the mechanism of theory of serial (abstract) machines can be adopted. However, a condition in the modelled system is the final number of parameters and the final number of statuses in individual time moments. To a certain degree this condition can be fulfilled by defining the processes, statuses and their components on interval ranges. We purposely came up to the description and interpretation of the model.

Formal General Description of the Model of Combined Instruction

Let us suppose that the controlled teaching system is formed by two subsystems, interdependent and cooperating, i.e. the system being educated (controlled object – student) and the teaching system (controlling object - teacher), represented as two serial (abstract) machines: S and T, characterized as two ordered fives of sets:

$$S = (INS, ISS, OUTS, \delta S, \lambda S)$$
$$T = (INT, IST, OUTT, \delta T, \lambda T)$$

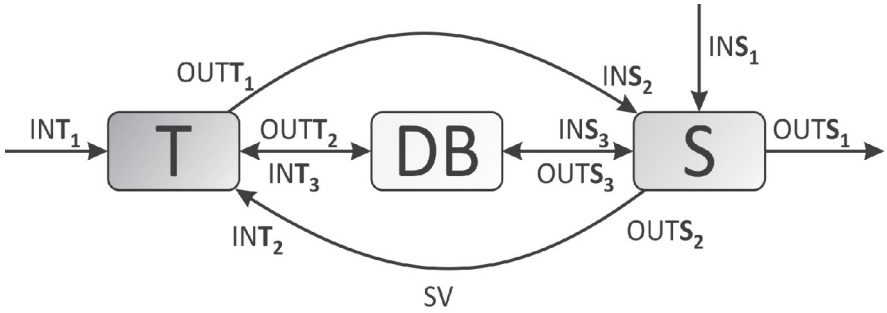

Figure 2. General description of a model of combined instruction.

INS, INT are the sets of inputs, ISS, IST are the sets of internal statuses, OUTS, OUTT are the sets of outputs, δS, δT are transition functions, λS, λT are result functions (both functions are defined on non-empty sets of inputs of internal statuses and outputs). One of our main research objectives is to design, based on the knowledge of the learning process, a cybernetic model of controlled instruction with the use of multimedia instructing applications for the combined form of education with the support of e-learning.

Model of Controlled Combined Form of Instruction with the Support of E-learning.

It comes out from the designed general model of combined instruction (figure 2). The learning process starts with the setting of teaching objectives, based on which teacher (tutor) gives instructions, tasks, tests, which the student should master and place them in the database. Each of the students is different, each has different knowledge, other internal motivation, other self-evaluation, other attitude to learning. Based on that, everyone sets his own aims of learning, which need not necessarily be in line with the teaching objectives. In order to fulfil these aims, the student chooses his unique procedures: learning strategy, strategy of learning and style of learning, and those would lead him to a certain set of results, which are monitored by the tutor based on the results from LMS MOODLE, or they are compared and assessed with the originally set objectives (with performance standards) in the databases. Then comes evaluation of the learning or teaching. In case of major discrepancies among the objective and the results there follows a correction of teaching procedures, or adjustment of objectives of learning in the student with the repetition of the whole procedure.

More experienced students can simultaneously observe and assess the monitoring of the course and results of the learning and teaching process, consider certain modifications in the employed strategies, strategies and styles of learning. And this is the way the cycle of self-regulated learning starts, when instruction gradually refines and improves, under the control of the student himself and using the adaptive elements of educational process.

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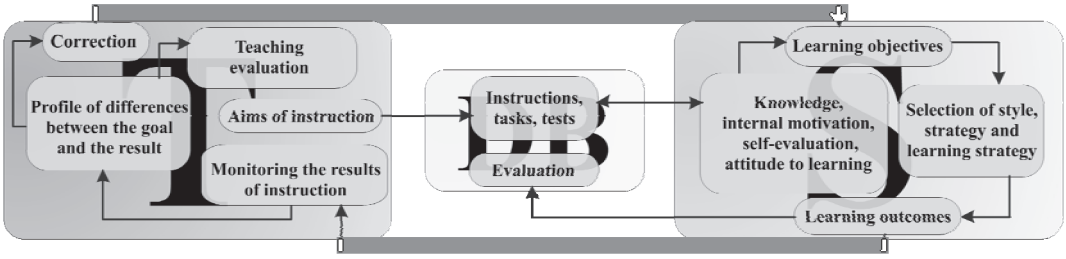

Figure 3. Model of controlled combined form of instruction with the support of e-learning.

In all the above described models the main elements are: teacher – T and student – S, which can be considered as subsystems, interdependent and cooperating. These two subsystems coexist in one space and time and outputs of one become inputs for the other. We deliberate that INTi are sets of all inputs for the teacher (T) and INSi for the student (S). Thus not only those, which are implemented upon communicating between them directly or through electronic environs, but including perceptions from the surrounding world, such as social environs, other teachers, other students, Internet, television, newspapers, material and technical means of instruction, etc. (Kulič, 1992).

The most important section of the instant research work is currently the assessment of quantitative and qualitative indicators of applying the models of controlled teaching with the use of LMS MOODLE in the study programme Applied informatics, thematic area „Technical and system means". However, for the assessment of these indicators it will be necessary to fulfil several partial goals:

- To prepare an e-learning course designed based on the knowledge verified during the stage of designing and verification of suitability of the given models of controlled teaching from the thematic area „Technical and system means" and to verify its effectiveness in terms of didactic efficiency and time necessary for the study of the given contents of instruction.
- To prepare good quality (objective, reliable and valid) electronic didactic tests from the thematic area „Technical and system means".
- To evaluate the overall benefit of the designed model solutions of teaching with an interactive multimedia support in the thematic area „Technical and system means", of the study programme Applied informatics (Khan, 2006).

An inevitable step towards obtaining relevant results is the knowledge of architectures of the designed systems, which can be applied to the proposed system of instruction with the support of e-learning.

We draw from the currently obtained knowledge of the teaching in the study programme Applied Informatics at the Department of Informatics. Student/client meets the environs, which allows him to obtain primary knowledge and experience with such instruction support. The many times discussed problem of support of the study by an e-learning method is solved from the point of view of the proposition of interconnection of a client and a tutor by designing a common environs, e.g. common frameworks in web medium. As mentioned above, for the study we chose the combined form of study, which is characterised by a certain number of contact/non-contact hours of the student and the pedagogue (tutor) (Pahl, 2007).

An important area in the complex evaluation of education with the support of e- learning is quality assessment of the designed educational software product. In this part of the contribution we shall try to outline the way of evaluation of the e-course (software product) and discuss on how to assess the e-learning system based on activities and requirements of the e-course student. The designed e-courses and their services are mostly Web-based and generally abide the „one size fits all" approach.

ISO 9126 is the quality standard for a software system with a hierarchical structure, defined by the metrics of qualitative overall and partial indicators of the assessed software system (e- course). The described ISO standard has a six-level structure of quality, namely: functionality, reliability, employability, effectiveness, maintenance, transferability. E-courses are divided into four categories: Access to sources, particular e-learning services, common services and presentation services (Drossos, Vassiliadis, Stefani & Xenos, 2008).

From the point of view of functionality e-learning system can be analysed as a set of functions and services, which are provided by the e-learning system to the user.

Functions of the e-learning system are defined as follows:

- Mechanism of personalized approach to the user of e-course, pedagogue, tutor, administrator; each user should have a different level of approach.
- Retrieval functions: simple detection by means of a keyboard and logical operators or advanced searching (retrieving through categories of teaching material, metadata, multimedia lookup, etc.).
- Multimedia, applications for digital material.
- Collaborative environs.
- Sharing and repeated use of knowledge.

The level and quality of the used metrics employed within the activity of e-courses can have a great importance not only from the point of view of quality of the e-course contents, but also in the sphere of management and the value of the system in a longer-term perspective of its use.

Conclusion

Web based technologies are the most suitable ones for e-learning, mainly thanks to their simplicity, flexibility and cost effectiveness. New blended or improved models use traditional methods of instruction in combination with static or dynamic tools, which are based on a simple web technology. Besides this, new technologies, which facilitate cooperation and experimenting, allow for not only reducing the costs of education, but also effective implementing of these models of instruction in traditional higher education institutions. During the last 10 years educational community witnesses a real revolution in the sphere of providing education. This revolution is mainly in the sphere of technologies: high-speed networks, quality and powerful hardware accessible to a simple user, multimedia with their interactivity and high definition as well as free access to information education sources are one of the trends, which allow us to use these big advantages of provided technologies.

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