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Modelling of Logistics of Educational Process in Petri Nets Environment

Abstract

The article is focused on the issue of whole-life education from the point of view of one of its distance learning forms: e-learning. One of the core problems of this field is self-study and its arrangement; specifically study materials and a correct organization of learning.

Key words: *e-learning, distance learning, study supports, logistics, processes and activities, educational process*

Introduction

Information and communication technologies influence people's work and life in a very important way in the modern whole-world information society. Whole-life education is slowly but surely becoming an essential necessity. Fundamental changes in the present educational process are inevitable. Education forms and technologies, which take advantage of all accessible information and communication means, are making their way onto the forefront of public interest. Words like: "Internet, e- learning, electronic education", slowly evolved in our republic and now are not as novel as they were a few years ago.

Universities have to keep up with the fast ICT development and adapt themselves to the "knowledge market". The main task is to adapt the educational courses or study programmes to e-learning for students. It is necessary to explain to people that systematic education from birth to the end of life is not mere fiction but a necessity for citizens to be continuously productive in modern society.

To predict the future needs and all details is not possible. But with a big certainty it is possible to predict the main directions of future development. Technologies

will accompany future generations throughout their lifetime and the success of education will depend upon the use of such technologies. In the educational process we now face fundamental changes in which new technologies will surely play predominant roles.

The efforts to **improve the pedagogical process** include increasing its explicitness and expanding its accessibility for a maximum of students. The so-called whole-life education has become a significant trend. One of the methods or means of whole-life education is the **distance form**.

Distance Education

The substance of the distance form of study is characterized by its name – distance. At present in the traditional form of study the educator and student are bound by mutual meetings in the classroom at an exactly designated time according to a timetable. The idea of distance learning is different. Distance learning is mostly self-study with the support of a tutor (educator). Students – for the study purpose – take advantage of educational materials, which ICT creates and provides in a multimedia electronic format (multiple delivery and a variety of forms – text, graphics, video, sound).

The distance learning process functions in such a way that the student works with study materials on CD ROM or logs onto an e-learning course through the Internet. An important part of any e-learning course is the communication with the educators, other students or directly with the information system of the institution. Student communication with the tutor and administration system represents a fundamental element which is necessary for controlled education. This element is feedback.

The practising distance form of study, which is realized in the e-learning form, requires certain necessary factors:

1. Constantly broadened abilities of the educators in the ICT area. This method of teaching requires larger demands on study material authors (multimedia). At present this form is not supported by the existence of any uniform methodology which would make it easier to create lessons and at the same time would increase their quality.
2. The need to manage and meet higher demands which are laid on the educational institution in connection with distance learning. Particularly in the sense of logistics and the organizational structure for this area.

Educational processes are formed by a range of different systems. The most frequent is an information system. The aim of an information system is to collect,

store and process, create, receive and send information. Information systems perform these operations (processes) automatically and/or according to user specified requirements.

If we want to study the behaviour of the real system, we have to design its model. The procedure will be exactly the same in the case of an education system.

Educational processes depend upon many specific factors which influence and complicate the execution of the processes. Petri nets have been used as one of the tools for the modelling of distributed systems. They enable a dynamic description of the educational process logistics.

Petri nets – tool for modelling of the processes

Petri nets provide an efficient means for modelling parallelism in discrete systems. Because they are in fact mathematical models, it is possible to use verification of some reality model with them. System modelling is an activity which enables a person to purposefully influence the system on the basis of gained knowledge. When we talk about this type of model, we must understand the abstraction of reality. Every system has its structure – it is constructed of system elements and of links between these elements.

The first step is process analysis, this includes existing processes mapping, identification of the activities, which are realized within the frame of processes, description of information flows, decision flows, range of responsibility and competence of activity administrators.

Processes can be charted in different ways. One of the most commonly used methods is the method of progress charts, which describe a given process using an advancement algorithm. Another method is entry of the processes map into charts. Both of these methods are statistical formulations of the solution. By transferring processes from a process map into Petri nets we obtain a dynamic representation of the modelling process.

A unified algorithm of the educational process that progresses from the student's acceptance of a given subject is used at almost every university with some minor differences (accreditation of the subject area, entrance examination, timetable creation, study). The purpose of this research is to work out this general process in more detail and to create a process model which will indicate the progression of the individual steps in the educational process.

I have chosen Petri nets as a tool for modelling. There is a set of distributed elements in the educational process:
 – Student

- Educator
- Timetable
- Study plan
- Etc.

Systems are usually relatively separated and autonomous. However, in a complex educational process they are mutually linked. That was the main reason for selecting the already mentioned Petri nets for modelling.

Educational process modelling

First the whole process was divided into 4 sectional parts while compiling the model:

1. ACCREDITATION
2. ENTRANCE EXAMINATION
3. TIMETABLE CREATION
4. STUDY

The following summary shows a proposal of individual activities in the frame of modelling of the individual processes.

Process – Accreditation of the subject field

1. Study subject strategy creation
2. Study plan drafting
3. Study materials preparation
4. Study materials completion
5. Accreditation file completion
6. Sending of the file to MŠMT (Ministry of Education)

Process – Entrance examination

1. Putting in the application for study
2. Entrance examination preparation (room, tests, examiners)
3. Sending letter of invitation to entrance examination
4. Entrance examination – knowledge testing
5. Evaluation of the entrance examination – receiving commission meeting
6. Notification about success (failure)
7. Administrative operation

Process – Timetable creation

1. Time schedule
2. Registration of students in subjects according to study plan
3. Students' enrolment in concrete timetable actions

Process – Study

1. Half-year term schooling of individual subjects
2. Register for exam
3. Passing exam

    4. Graduation

These partial models were created in the software system HPSim and their correctness was analyzed by simulation. The diagram of the complete educational process is shown by using Petri nets – *picture 1.*

…and one module showing sub-process "Timetable creation" – *picture 2.*

The result is a process model of the progress and organization of the study, from the student's acceptance of this study until his/her successful graduation. Petri nets have been used as models for thesimultaneously occurring dynamic actions for the sphere of organization, logistics and generally for the study progress.

The modelled educational processes with the help of Petri nets is generally applicable for any study subject – humanistic, scientific, technical or pedagogical. It enables well-arranged and illustrative orientations in individual educational processes for any interested persons, even those who are not very well informed about the problems or possessing an understanding of Petri nets.


Conclusion

The introduction of information technologies into direct education control is at the present time a very desirable aim of modern educational institutions. The form of education that is supported by modern information and communication technologies will have a larger and more dominant importance in the struggle for the student. This form of study enables access for people interested not only in specialized, contemporary and modularly arranged information that are not only accessible in the form of multimedia interpretation, but also in the form of operation and feedback. This educational process enables all interested people to increase necessary qualifications without time or geographical limitations. The problems of this education form are connected with the methodology of creation of educational materials, their handing over to students in a suitable form, the managing of the educational process and many other problems. With respect to the above-mentioned facts this research addresses a very up-to-date topic and provides development of a dynamic system with the possibility of direct application into the concrete phase for educational institutions.

Picture 1
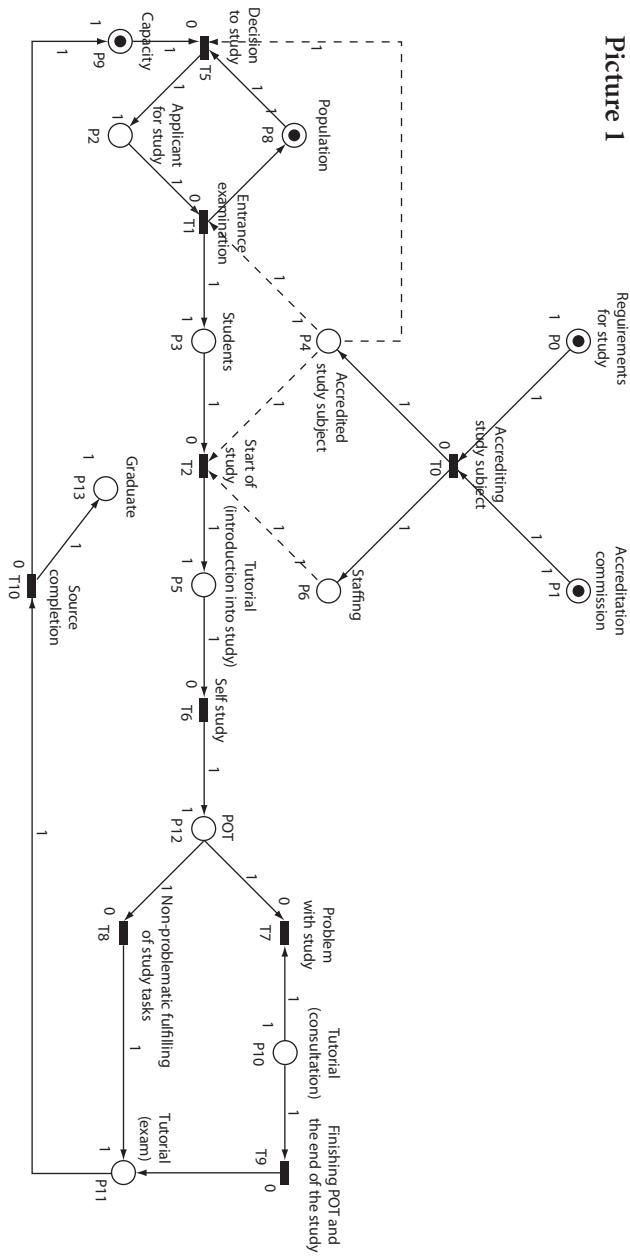
Picture 2

Picture 2
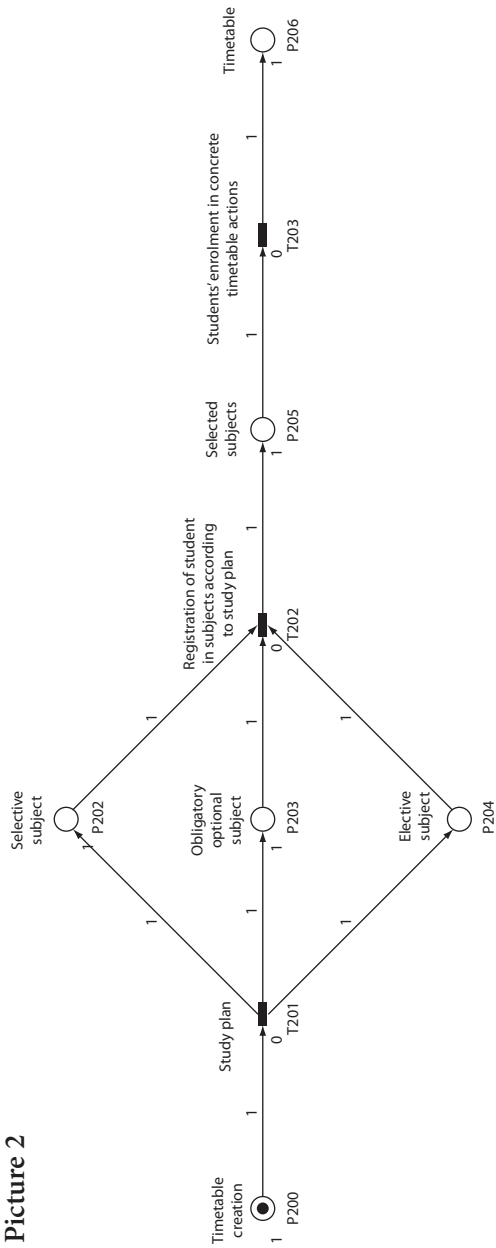
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