14 Web-based Model of Engineering Studies Developed by Warsaw University of Technology

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Abstract

The article gives a review of reasons for developing and adopting a new web-based model of studies by Warsaw University of Technology. That is followed by a description of the Internet and multimedia-based educational model, known as SPRINT. The article presents also a structure of the four-year engineering studies offered by Electrical Faculty, Faculty of Electronics and Information Technology and Faculty of Mechatronics for given specializations. Then follows a description of the structure and tools of the electronic books. Finally, the article discusses briefly ways of further development.

Keywords: Distance learning, open education, asynchronous learning

1. Introduction

In the 1970's and 80's Distance Learning was perceived as a model of entirely different nature than the traditional one. That approach led to establishment of separate university units whose task was to conduct 'distance' studies. As a result, several Open Universities were established in Europe, e.g.: Open University in Great Britain (1972), FernUniversität in Germany (1974), Universidad Nacional de Educacion a Distancia in Spain, a federation of universities – Federation Interuniversitaire de l'Enseeigment a Distance – FIED in France, or NETTUNO, a network of Italian universities, established in 1990. However, the emerging new technologies, particularly the invention and spread of Internet, forced many European universities to follow American universities in the process of introducing new technology in the university learning. The adoption of a new form of learning, Continuing Education and Distance Learning, co-existing with the traditional form of education resulted in establishment of a new model of university.

Traditional model of education is based on a direct face-to-face contact between student and teacher, in which textbooks play a role of additional self-learning tools. New technological developments, such as computer-based technology, telecommunication, multimedia, Internet and television, have enriched a traditional classroom with new tools, improved learning quality in both residential universities and geographically-dispersed learning groups. Of all the technical innovations, the Internet has become an indispensable tool in introduction of the new technology to education, and its growing impact on the future of the educational model is inevitable.

In the 1990's, Warsaw University of Technology initiated a series of actions whose objectives were to reform and modernize available forms of education. The WUT introduced a three-degree model of studying (B.Sc., M.Sc., Ph.D.), extended the Continuing Education system by adding new post-diploma courses dealing with information and communication technology, and contributed to the improvement of multimedia literacy needed in the production of new didactic materials.

Two years ago, the university authorities agreed it was high-time the WUT developed and introduced a new model of studies. The Internet and multimedia have become the basic tools of a new model of education – known as SPRINT (in Polish: **S**tudia **PRez INT**ernet).

The present paper offers a short description of the new model of education adapted by WUT.

2. Facts about SPRINT.

A variety of asynchronous technologies are used in the contemporary model of studies (Minoli 1996, Taylor 1999, Farrel 2001). Thus, to the basic tools used by student in a Distance Learning belong: computer and Internet. These tools enable e.g.:

- access to Internet,
- e-mail correspondence/communication,
- work with didactic materials stored on CD-R,
- solve tasks and problems,
- write reports and projects, etc.,
- online meetings with lecturers and other students.

Although direct, face-to-face contacts between student and teacher are very rare in the SPRINT model, they are considered as important and essential elements of education. Thus, every year students have an opportunity to meet with tutors during one-week laboratory and research meetings. During that time students are instructed how to use measuring apparatus, conduct scientific research (computation and simulation) with

the use of advanced software. The final examinations, preceded by a series of meetings with professors, are also conducted in the university.

The four-year studies lead to a degree in engineering (B.Sc.) of a chosen faculty and specialization. The academic year is divided into four half-semesters: autumn, winter, spring and summer, a system practiced in the FernUniversität Hagen. Each semester lasts 8 weeks and finishes with two-week examination sessions. Fig.1 shows the structure of the four-year studies.

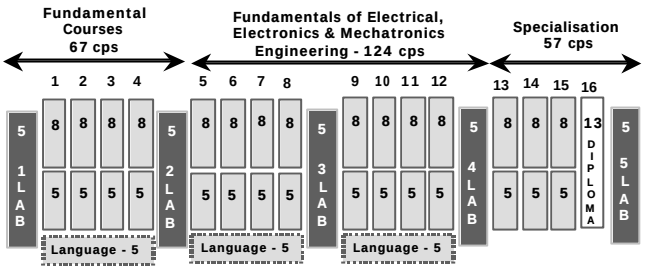

Fig.1 The structure of the four year studies

The division of the academic year into four and not two parts, enables students to study no more than two subjects at the same time.

The SPRINT model offers three types of subjects:

- **Major** subject, worth 8 cps, which ends up with an exam;
- **Minor** subject, 5 cps, which also ends with an exam;
- **Laboratory session** (one week long), 5 cps.

The problem of foreign language teaching will be discussed in a separate publication.

The grading of the subjects is based on the credit points system (cps), established by and used in the university teaching system in the majority of European countries. The credit system gives students the opportunity to gain credit points (credits). The total number of credits for the subjects is 248.

There is a three-level system of study:

- **Fundamental courses**, 1 year, whose program is fairly universal and basic; within the course student is required to credit 4 Major courses, 4 Minor courses and 2 Laboratory sessions, which gives minimum 67 cps.
- **Faculty courses**, 2 years, whose program is dependent on the faculty chosen; student is required to credit 8 Major courses, 8 Minor courses, 2 Laboratory sessions, and finish language course, which gives 124 cps.
- **Specialization courses**, 1 year, one faculty can offer more than one specialization; student is required to credit 3 Major courses, 3 Minor courses and finish a diploma thesis, which gives 57 cps.

According to the requirements of the program of studies every student should credit at least one Major and one Minor course per half-semester, and during summer semester gain credit for the laboratory session.

The model of the studies is entirely open. It means, one can become a 'regular' student of the Warsaw University of Technology and credit all the courses required to get a diploma in engineering, one can also study chosen courses, or group of courses as a 'short-term' student.

In the SPRINT model the process of expelling students is avoided. At least once in a year, progress of 'regular' students is verified. In order to be admitted to the registration for the next year student should have at least half of the required points for a given year.

Thus the pace of individual learning and gaining credits is student dependent. However, to keep the status of a 'regular' student one should not have less than 50 % of required points.

If the student is not registered for the next year, he still has a chance to continue his education. He keeps all his credits and has the opportunity to gain further credits and short before the last year of studies the student is enrolled once again.

3. Faculties and specializations

The introduction of an entirely new model of studies by the WUT, a university with 30 thousand students enrolled in 18 faculties, had to be accompanied by the establishment of a new university unit – Centre of Open and Distance Education CODE (in Polish: Osrodek Ksztalcenia na Odleglosc OKNO).

As a principle, CODE does not have full time academic teachers. The lecturers of the particular faculties are responsible for the production of didactic materials, student supervision, and conducting examinations.

The three faculties of the WUT, Electrical Faculty, Faculty of Electronics and Information Technology and Faculty of Mechatronics, offer courses in the following specializations:

- Industrial Informatics (Electrical Faculty),
- Computer Engineering (Faculty of Electronics and Information Technology),
- Multimedia (Faculty of Electronics and Information and Faculty of Mechatronics),
- Mechatronics (Faculty of Mechatronics).

The Fig.2 presents the structure of the studies program offered by particular faculties.

The Fundamental Courses, offered during the first year of studies (Mathematics, Physics, Fundamentals of Informatics), are universal courses that can be adopted by every faculty of the WUT.

Fundamentals of Electrical, Electronics and Mechanical Engineering offer a set of courses for the second and third year of studies. The number of common courses for each specialization is relatively big. As a result, students have the opportunity to attend the majority of the offered courses.

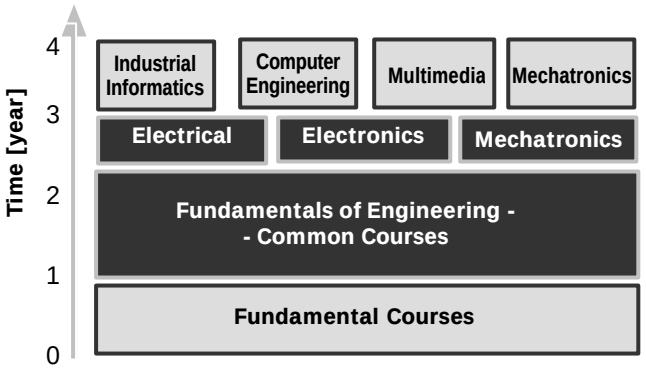

Fig.2. Program of studies structure.

During the fourth year of studies students attend only courses of their specialization and work on their final thesis that leads to a diploma.

Every year students have the choice between several courses, whose number increases with the progress of introduction of new didactic materials.

4. Electronic Books

The didactic materials of the particular courses are prepared by professors and experienced tutors in the form of electronic books stored on CD-R. The material is also available via Internet. The electronic books have the advantage of presenting the whole material of a single subject on one CD-R, and the cost of copying the material is relatively low (Kaskine 1999, Michau 2001).

For the production of the material the DynamicHTML technology was used, including: HTML, Cascading Style Sheets, Java Script and FrontPage tools. Thus the navigation system is based on HTML and dynamic Web page processing by Java Script.

The material of an electronic book is divided into two main parts:

Introductory part,

A. Learning Units and Exam requirements.

B. The introductory part includes:

- **Authors' note**, which describes course objectives. The authors explain what level of knowledge and what skills are expected from students after examining all the materials presented in the book.
- **Requirements for computer** – includes description of requirements for computer.
- **How to use an electronic book** – it is a clear, step-by-step instruction of how to use the material stored on the CD-R. Although it may seem to be obvious for the most of the students, it may turn out to be a real help for others.
- **What to know to understand?** – the authors explain conditions for understanding the didactic materials: minimal level of knowledge enabling student to understand the material presented.
- **Examination requirements**, this element is included only if the given course ends with an examination.

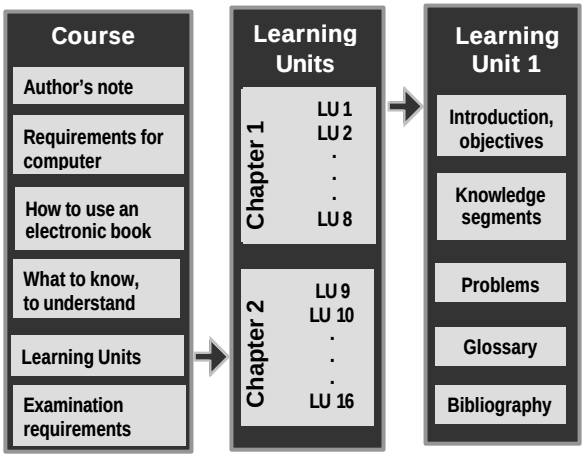

Fig.3. Structure of the electronic book

The Learning Unit part includes a series of basic didactic units that should be learnt in a suggested order. Every learning unit is composed of several basic elements:

- **Introduction**, objectives, which presents the aim of the particular Learning Unit.
- **Knowledge segments**, which includes basic didactic material required from the students. Some parts of the material contain additional information for further reading.
- **Problems**, this part includes examples of partly solved problems and tasks to be finished by the student himself. Also, it enables students to revise their understanding and command of the material required during examinations.
- **Glossary** – includes new terms and definitions.
- **Bibliography** – a list of important publications for further reading.

The electronic books have an advantage over traditional textbooks by presenting the material in different ways: written

form, audio-video, simulations and animation etc. These tools enable easy and fast understanding of the course materials.

5. Plans for the future development.

The new web-based model of undergraduate engineering studies, SPRINT, adapted by the WUT is still in a forefront of really important developments.

More technical innovations create new possibilities. Thus, one of the objectives of the WUT is to develop and enrich the model with a set of new multimedia tools e.g. production of DVD, designing new simulation tools etc.

As for research, convenient conditions for conducting experiments and laboratory analyses "in a distance" need to be created. Such laboratories would enable students better understanding of studied subjects. Our knowledge concerning processes resulting from experiments, ability to control these processes and a set of tools needed for digital recording and transmission are enough to introduce a new model of laboratory research – 'distance research'. The introduction of the model is a forthcoming development of WUT.

The WUT considers also installing an advanced software that would improve the quality of projects and computer-aided simulations created by students.

Another objective for the future is the establishment of a network of universities offering distance education. This would lead to creation of a new model of distance education based on the NETTUNO model.

6. Conclusions

As soon as the new model and program of studies was approved by the university authorities – May 2000, a group of specialists and tutors started production of new electronic books.

A group of computer scientists, with the help of IBM Lotus-LearningSpace software platform, prepared an educational portal.

In October 2001, two hundred students enrolled and started education in a new web-based model of undergraduate engineering studies.

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