PREFACE

Global issues standing before the generations that have already stepped into the third millennium are related to the exhaustion of fuels and continuous deterioration of the environment. The future of human kind depends on the models and solutions proposed which are nonetheless insufficient. Thus, new efforts are crucial, efforts to stimulate innovation under all its aspects - scientific, technical, technological or human.

At present, projects are being launched in Europe for sustaining the strategies for creating the European higher education and research area, an area defined by the Bologna process that was initiated by the Lisbon Declaration and by the representatives of all EU member countries to join the common knowledge area.

Obviously, one cannot get things to progress without innovating the educational system. Present debates on the role of schools and universities in the contemporary society focusing on the results of education and their connection with the human being, society, culture and civilization usually reach polyvalent answers.

The Bologna Conference, as well as the actions that followed, revolves around these issues: school in general, and mainly universities are the engines that powers the development of the society, and reforms sustain this ideal.

Just as Professor Ion Mihailescu stated at the Rectors' Conference of Francophone Universities (Bucharest / Sinaia November 11th – 13th 2004) "the Sorbonne-Bologne process is not a plot against tradition, but an attempt to respond to present challenges ".

Innovating in education for lifelong learning supposes the accepting of new paradigms, among which:

- the transition from a conceptual curriculum - focusing on notions – to a skill-based curriculum, where we take into account different types and ranges of skills, especially cognitive and social skills, interdisciplinary and pluridisciplinary organisation skills, and the use of reference words such as - "to solve", "to have a critical thinking", "to decide" and "to create";
- new educational principles are introduced: teaching lifelong learning (teaching how to learn), openness towards new concepts, access to information - as knowledge is never completely accomplished - the concern towards individual performance as related to one's own potential;
- new pedagogical methods are introduced, where we focus on the interactive style in the trainee - trainer relationship:
  - the trainer/educator plays the role of a mediator for trainees' access to educational values;
  - the teaching process consists in organising, guiding the learning process and in taking decisions favourable to learning.

Interactive learning methods are supported by the constructivist learning theory, an approach first presented by Seymour Papert and his colleagues from MIT Cambridge, Massachusetts, who consider that constructivist learning is successful when the 'trainee" gets involved in constructing a product (machine, programme, book etc.), or in any kind of application.

When designing and developing new interactive methods one must take into consideration the features of constructivist learning, among which:

a. Seeing the trainee as a single individual - this involves transferring the responsibility to the trainee: even if the information is incomplete, he must find meanings, rules and order in the events of the real world;

b. Motivating trainees to learn - The feeling of confidence in the probability of solving a problem deriving from previous experiences and problems has a greater importance than external motivation;

c. The instructor is a tutor - The role of the instructor is major in this respect, new findings are connected to setting new teaching-learning-evaluation methods, in the perspective of redefining the final results of education. Teaching means: organising, guiding and evaluating learning situations with the purpose of improving them. Teaching is an external condition of learning. Learning can happen before and/or after teaching. To be able to play this role, the tutor must have a different set of skills as compared to the teacher's and who uses traditional teaching methods;

d. The nature of the learning process - Learning is an active, social process during which trainees can learn **to discover** principles, concepts and events; a meaningful learning process is the one in which the individual is socially involved;

e. The dynamic interaction between tutor's and trainee's tasks - There appears a special bond between the tutor and the trainees, where they compare beliefs, values and standards. Learning is an iterative process, which contains theoretical, adaptive, interactive and reflexive elements;

f. The collaboration in the group of trainees – Trainees having a different background and customs can collaborate for the assignments so as to find and understand the truths in a certain field;

g. Evaluation - Learning and evaluation are no longer separate processes. Evaluation is a dialogue in which the trainee sets the performance level and how it can be improved;

h. Selecting and organising the content - Information shouldn't be divided up in different subjects instead it should be discovered as a whole. The reason why it should be so is that the trainee lives in a world, which contains numerous facts, problems, dimensions and perceptions and is not divided up in subject matters;

i. The structure of the learning process – During the learning process one seeks creating a balance between the level of organisation and the level of flexibility. The more structured the learning environment, the harder it will be for the trainee to build new meanings.

An efficient, interactive, constructivist-based learning method is **Problem based Learning** PbL), where the responsibility of learning is transferred from the trainer to the trainee. The learning process through these methods begins with the tutor's presenting a **problem situation**. Based on the presented issue (related to the real world, but which covers a certain content), trainees are then invited to a group discussion. They analyse the causes and the features of the situation, the trainer asks questions that can be turned into target issues or learning objectives. By analysing the problems, the already acquired knowledge is reactivated and trainees are motivated to find answers to their own learning objectives through their independent and group activities.

As opposed to **Problem solved learning**, **Problem based learning (PbL)** only contains the presentation of a conflictual situation (problem situation), its analysis, the enunciation of the solution, which usually is of maximum generality and finally writing a report. All complementary activities remain valid. The main purpose of Problem-based learning is to emphasise the knowledge that each and every trainee lacks. Thus, they will be motivated to complete it through individual study and group activities.

Project based learning (PjL) is based on the same principles and phases but, as opposed to the PbL method, which is mainly used for individual education, the PjL method provides a pluridisciplinary approach to a certain issue.

The issues presented earlier were treated within the Leonardo da Vinci pilot project RO/04/B/F/PP – 175016, bearing the title *COMPLETE* - "*New Strategies of **COMP**etence Acquisition for Lifelong **L**earning in **E**nergy – **T**ransport - **E**nvironment **E**ngineering*".

Project coordinated by *Transilvania* University in Braşov, Romania, with partners from UE institutions: *Paris Diderot - Paris 7* University – France, *Louis Pasteur* University of Strasbourg

– France, Gent University - Belgium, UNINOVA - Institute for New Technologies, Lisbon - Portugal, *Laboratorio delle Idee* in Fabriano – Italy, a company specialised in developing media means for educational purposes - together with the Romanian institutions: *The Romanian Agency for Energy Conservation*- ARCE, *The Tempus Association for Lifelong Formation* - AsTEC, and *The National Institute for Road Vehicles* – INAR Brasov.

The COMPLETE project promotes and encourages trainers to use innovative interactive methods, as PbL and PjL, in the process of education. The training programmes are dedicated to specialists, and to trainees who graduated higher education institutions in the field of Energy - Transport - Environment. The key words associated to this project are: multidisciplinary, interactivity, performing virtual environment.

By approaching issues from the Energy-Transport-Environment fields, which represent prioritary segments in the European strategy for sustainable development, the COMPLETE project suggests identifying the important issues that support problem solving and multidisciplinary projects. The complexity of the environmental issue requires an inter- and multidisciplinary approach, where knowledge is acquired through complex connexions, from terms, concepts, to processes interacting in concrete situations.

For instance, a situation in transport - the level of pollutants coming from road transport - leads to multidisciplinary problems: mechanics, thermotechnics, fluid mechanics, chemistry, electronics, electrical engineering, recycling materials, measuring and sensors etc. Another example, a situation in energetic domain – increase of energy consumption - leads to complex solutions related to diminishing pollution, increasing return rates and energetic efficiency, using alternative energy sources, which can be approached only when referring to multiple study subjects.

Interactive learning methods require a specific communicational environment, with a virtual classroom where both trainer and trainee must be ready to communicate. In this respect, the COMPLETE project provides solutions for improving the quality of communication in a virtual environment, by using the COMPLETE virtual platform (http://complete.unitbv.ro/) which features: storing learning materials, complex communication tools (forums, chat, e-mail), providing information and developing the individual within the group, a frame for quality management of the information selection and processing that ensure communication feedback as well as a good administration of the evaluation process (homework activities, tests of different categories and of various difficulties, glossary, etc.)

The project sustains the initiative of organising post-graduate training programmes and/or specialisation in Energy-transport-Environment, by using the developed products. The courses are dedicated to higher education graduates developing their activity in the energetic, mechanic, electric, thermal engineering, road transport and vehicle exploiting, construction and environment fields trainees who wish to update their knowledge by using modern learning methods. As always, within these courses, or while studying a book or information printed on a CD, one can find a corresponding course on the COMPLETE platform, where each trainee get a user ID and a password that will ease the learning process, through the fact that he has at his/her disposal, anytime and anywhere, not only the list of references but also the self-evaluation activities.

The course dedicated to transport is entitled **"Advanced Road Transport Systems"** and it includes the following modules:

- Module 1: **Road traffic flow management**
- Module 2: **Intelligent road transport systems' architecture**
- Module 3**: Telematics applications in advanced road transport systems**

For facilitating communication and assimilating knowledge concerning the use of the educational e-platform and of interactive methods, the COMPLETE project provides the organisation of a "**Techniques of Communication"** module.

The COMPLETE project has sustained and developed the learning materials for these educational modules. Together with the resources developed through the project, after going

through the modules and evaluation, the graduation projects created by students are included on the COMPLETE virtual educational platform, thus becoming new learning materials.

The present work "***Advanced Road Transport Systems***" includes learning material elaborated by the teaching staff from *Transilvania* University in Brasov, INAR – Braşov, Gent University and UNINOVA, Lisbon – Portugal, and they were designed to satisfy the training needs of graduates' working in transport engineering, as well as in the fields related to it (goods and persons transport companies, road police services, town halls services, inspection services).

Learning material presented as a book is organised in three parts corresponding to the previously stated modules:

Part I: Road traffic flow management gives the opportunity to understand the importance of traffic data sources as well as the methods used to collect them through remembering statistical skill and probability theories, such as central tendency, distributions and methods of statistical testing, errors, queuing theory and other applications specific to traffic engineering.

As to understand and solve problems occurring so frequently in the road network, climaxing with traffic jams, we can find explanations on basic traffic parameters and the relations among them. Taking into consideration the fact that over 90% of road accidents are due to human errors, drivers, pedestrians, cyclists, etc., the work includes a chapter dedicated to identifying their main characteristics of human behaviour in special situations. Vehicle's characteristics that can influence the safety on the roads, as well as the main elements of design of road arteries - conflict points, visibility distance as well as notions related to traffic flow control are presented in this first module.

Part 2: Intelligent Road Transport Systems' Architecture, presents the background of the development of intelligent system architectures, starting from the first applications at international level, and focusing on basic components of a complete system. Aspects regarding system engineering and the application of life cycles models within intelligent transport systems are also presented in this part. User's services are described in detail and moreover, this part provides links to websites explaining and visualising the subsystems of an Intelligent transport system's architecture.

Part 3: Telematics applications in advanced road transport systems. This part includes all telematics applications at road infrastructure level and at vehicle level. The concept of intelligent vehicle is defined and systems used to transform a "traditional vehicle" into an "intelligent vehicle" are presented. Furthermore, this chapter describes in detail the vehicle and pedestrian detection systems using various detection technologies, positioning and tracking systems, but also methods of processing of recordings for identifying the licence plates.

The authors of this book wants to show the level of knowledge in transport engineering today and to emphasize the need to continuously improve the highly qualified human resources as to find appropriate solutions for optimising road traffic with the purpose of increasing the level of road safety - through reducing the number of conflict points, diminishing the negative impact on the environment, reducing fuel consumption and implementing applications from electronics and telecommunications.

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