

ÓBUDA UNIVERSITY

CINTI 2011

**12<sup>th</sup> IEEE International Symposium  
on Computational Intelligence and Informatics**

*2011, November 21–22 • Budapest, Hungary*

**PROCEEDINGS**

IEEE Catalog Number: CFP1124M-CDR

ISBN: 978-1-4577-0043-9

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# CINTI 2011

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IEEE Catalog Number: CFP1124M-CDR  
ISBN: 978-1-4577-0043-9

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**Granular Interval Type-2 Membership Functions and Modeling Application on a Nonlinear System**

**Cenk Ulu, Müjde Güzelkaya, Ibrahim Eksin**  
Istanbul Technical University, Istanbul, Turkey

**A New Deterministic Source Coding Method in Peer-to-Peer Systems**

**Attila Balaton, Tamás Lukovszki, Ádám Agócs**  
Eötvös Loránd University, Hungary, Budapest

**On Types of Parallelism, Conflicts and Cooperation in Grammar Systems**

**Alica Kelemenová**  
Silesian University in Opava, Institute of Computer Science and  
Research Institute of the IT<sub>4</sub>Innovations Centre of Excellence, Opava, Czech Republic

**ANFIS-based Parameter Estimation of One-Diode Equivalent Circuit Model of PV Modules**

**A. A. Kulaksiz**  
Selcuk Universit., Konya, Turkey

**On Genetic Algorithm Methodology for Robust System Design**

**A. M. Shamsieva, V. U. Arkov**  
Ufa State Aviation Technical University, Ufa, Russia

**Methodology of Implementing Information Technologies in Education**

**Zsolt Námesztovszki\*, Márta Takács\*, Dragana Glušac\*\***  
\* University of Novi Sad, Hungarian Teacher Training Faculty, Subotica; and Óbuda University, Budapest, Hungary  
\*\* University of Novi Sad, Technical Faculty "Mihajlo Pupin", Zrenjanin

**An Integrated Intelligent Inventory Control System for a Marble Plant**

**Suat Kasap**  
Hacettepe University, Turkey

**Soft Clustering Algorithms based on Neural Networks**

**Lenka Skovajsová\*, Michal Rojcek\*\***  
\* Institute of Informatics, Slovak Academy of Sciences, Slovakia  
\*\* Catholic University in Ružomberok, Ružomberok, Slovakia

**An Ontology-based Rule Chaining Algorithm for Legal Expert Systems**

**András Förhécz\* and György Strausz\*\***  
\* Multilogic Ltd., Budapest, Hungary  
\*\* Budapest University of Technology and Economics, Hungary

**Adaptive Sliding Mode Control for Quadrotor Attitude Stabilization and Altitude Tracking**

**Hakim Bouadi\*, S. Simoes Cunha\*\*, A. Drouin\*\*\* and F. Mora-Camino\*\*\*\***  
\* Automation and Operational Research Laboratory (LARA) in the National Civil Aviation Institute-ENAC, Toulouse-France  
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# Methodology of Implementing Information Technologies in Education

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**Abstract**—In the information society of nowadays, implementation of modern technologies is of key importance. Intensity and methods of this implementation define the efficiency of learning. Different learning environment, the methodological characteristics of IT learning and different prerequisites for learning result in different outcomes at the end of the learning process. Nevertheless, correctly used hardware, software and methodological principles help to realise a more effective educational system. This paper studies the aspects of implementing information technologies in education, the methodological characteristics of IT learning, several useful software that can be used in this process, and the prerequisites for adopting IT concepts and developing IT skills.

**Keywords:** methodology, information technologies, implementation, education, prerequisite

## I. INTRODUCTION

Today, with significant importance of information technology in our society, we cannot imagine a serious business or everyday life on this planet without computers. In fact, living in front of and with computers has become a common routine. Network communication, interactivity and fast transmission of information are also important in the life of individuals who live in the information society. Adoption and development of such skills are the main prerequisites for these citizens to become full participants of the information society, and therefore are of particular importance.

## II. METHODOLOGICAL CHARACTERISTICS OF IT LEARNING

The implementation and application of modern technologies have some methodological characteristics. Students have to face IT contents not only within IT course, but also during learning other subjects, as well as in their everyday life.

The best solution for teaching IT contents is the method when every student has his/her own computer during classes in informatics labs. Due to this structure of teaching, every student has an active role.

The ultimate goal of teaching IT contents is to build up a system of skills, which is flexible and can be improved (can be used in other software and hardware

environment). It also prepares students for using several IT tools, for independent learning, for searching and classifying contents from the Internet, for safe use of the Internet and for the challenges of e-learning.

Teaching methods can be frontal, individual, pair work and teamwork. Depending on the intensity of their application, we can classify educational environment into:

Traditional educational environment: traditional teaching tools and traditional forms of work have predominance in educational processes. This environment is determined by frontal form of work and traditional teaching tools (for example: models, printed documents, photographs, collections and albums). Computer and other IT hardware are not present in this educational system.

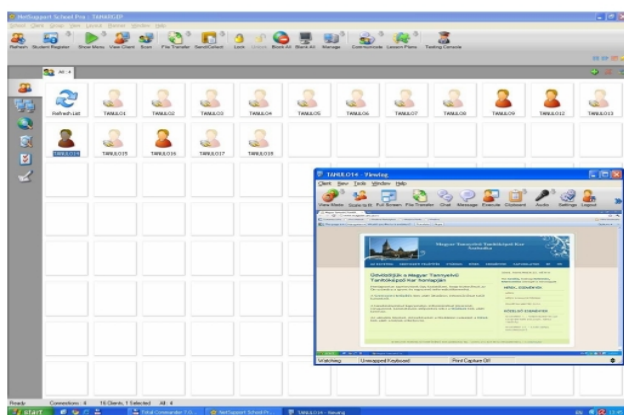
Combined educational environment: this educational environment is determined by one computer and one projector per class or group. Computers and projectors are used by teachers, in most cases for presenting PowerPoint shows or contents from the Internet. Teaching takes place in classrooms, and information technologies are used for supporting teachers' performance.

Interactive educational environment: determined by intensified application of modern hardware and software tools in educational processes. Teaching takes place in informatics labs. Apart from computers and projectors, there are interactive whiteboards, response systems and multimedia tools. The greatest advantages of this system are the interactive form of work, animated students, frequent feedback information, modifiable contents (files) and the use of multimedia. The disadvantages are time-consuming preparation for school classes, potential technical problems (with hardware, software and power failure), necessary hardware tools and basic hardware and software knowledge.

## III. SEVERAL USEFUL SOFTWARE TOOLS IN EDUCATION

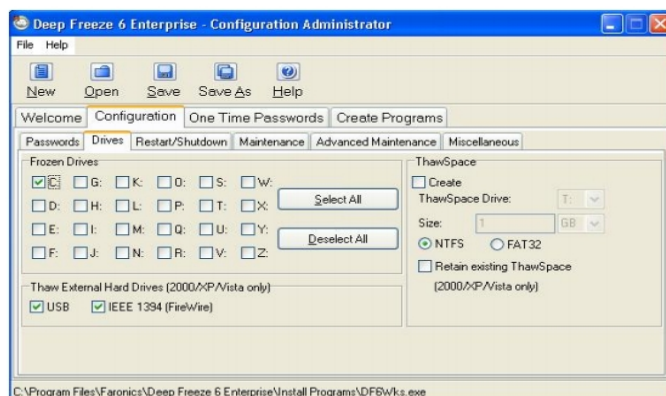
Hardware of the workstations in informatics labs (configurations, LAN) is important in the education process, but the software and the utilities on these workstations are equally important. Such software can help teachers to provide better and more effective courses.

One of the main informatics lab software types assist in management of desktop computers and their users. The leading software for classroom management is NetSupport School. During the installation we can change the mode of installation for using the software as a Tutor or a Student. In Tutor mode the teacher can control the workstations, while Student mode must be installed on the workstations. In this software it is possible to watch, share or control the desktops of the workstations. It is also possible to send instant messages or begin chat between the teacher's computer and the workstations, send files, show the screen of the tutor's computer on the monitors of the workstations (useful when an interactive whiteboard and a projector are missing from the classroom). It can manage (or disable) the input devices, the audio volume, or even log off, restart or turn off the workstations.



Picture 1. NetSupport School Tutor interface with icons of workstations and watching screen.

Since students download different contents to the workstations in informatics labs, they may modify the configurations and slow down or even crash the operating system. To prevent this problem we can use a type of software called system restore software. One possible solution is Faronics DeepFreeze. With a simple restore point, this software protects the original configuration of workstations, helps to prevent from unexpected and unwanted changes. Restore-to-reboot system provides smooth and quick work in informatics labs, and restores selected drives, partitions or files during reboot or starting of the operating system.



Picture 2. DeepFreeze administration panel with optional configuration (freezing drives).

#### IV. IT SKILLS AND COMPETENCES

There are several answers to the question what skills and competences are necessary for members of IT society. The objectives of education in the European Union are summarised in the so-called "White Book", which contains the following important statement: "The theory, which says that for better understanding of the world outside school it is essential for students to leave the educational institutions with the widest knowledge possible, is more and more popular. Experts have already agreed that there is no contradiction between broad fundamental enlightenment and the specific competences oriented towards more specific areas." (...) "We need to build skills that are needed for lifelong learning and the most important prerequisite – a positive attitude towards learning."

"The condition for these adults to learn consistently and continuously is will. If they had negative experience of learning in their early childhood – if the first attempts were without any success, they will not continue learning after graduation. The most important factors that affect learning throughout one's entire life are self-motivation that encourages learning and a wide choice of learning opportunities. Everybody should be provided every opportunity for learning with content selection, instead of being forced to learn predetermined contents. All this means that the system of education and training must be adapted to the needs of the individual, not vice versa" (Memorandum on Lifelong Learning, Brussels, 30 October 2000).

It is visible from this strategic document that lexical knowledge is not predominant. The key factor is to adopt and to build the ability of learning (learning to learn). More and more experts say that the idea of Lifelong Learning will have a strong impact on the objectives of teaching process, on the educational systems, as well as on educational institutions at all levels.



## V. PREREQUISITES FOR ADOPTING IT CONCEPTS AND DEVELOPING IT SKILLS

Concerning the success of the adoption of IT concepts and skills among adults, it can be concluded that there are so-called key factors for successful adoption:

- Age: we can say that the age is one of the most important factors that determine the success of adoption. Younger generation, the so-called "cyber" or "net" generation that already has prior knowledge, is motivated to learn IT concepts. In addition, this generation is defined by interactivity, fast communication and knowledge of ICT systems. IT skills are increasingly improved within younger generations, while among the older these skills, knowledge and interactivity are often lacking, thus they often encounter various barriers to learning.
- Having a computer at home and using it at the workplace: the daily use of computers significantly contributes to improving and increasing basic computer skills (using the mouse and the keyboard), and to the practical application of IT concepts (types of menus, left click, right click, double click, click, starting-up and closing programs etc.).
- Knowledge of English: as most software programs are in English, knowledge of computer terminology of basic concepts is extremely important, and this is one of the most important categories of competences. Beside learning, knowing English is also essential in understanding and solving new problems (using Help menu).
- Education and job profiles: it is assumed that education has positive influence on the further adoption of concepts and the development of new skills.
- Motivation: motivation in learning is a psychological factor that positively affects the entire process, contributes to time and energy invested in learning and bridging some difficulties that occur during learning.

During our research we analysed these key factors, we found the connections between them, and finally we showed the connection between these factors and the success of adoption.

### Subject of the research

Starting from the outlined formulation of the research problem the subject of this research is: "The success of

adoption of IT concepts and skills among adults with respect to age, owning a computer at work or at home, knowledge of English, qualifications, job profile and motivation of participants."

### Objective of the research

The aim of our research is to measure, analyse and present statistical differences of the success of adoption of IT concepts and skills between different groups. Groups are formulated based on the following characteristics: age, daily use of computers, knowledge of English, qualifications and job profile, and motivation.

### Research hypotheses

The hypothesis of the current research is made based on the findings of our previous studies that had defined the objectives of this research project.

The hypotheses of this scientific research are as follows:

- Younger people adopt IT concepts and improve IT skills more successfully,
- Having a computer at home and using it (daily) at workplace positively influence the adoption of IT concepts and the development of IT skills,
- Knowledge of English positively affects the adoption of IT concepts and the development of IT skills,
- Qualifications and the level of education have a positive influence on the adoption of IT concepts and the development of IT skills.

### Research methods - techniques, procedures and measuring instruments

Research participants had volunteered to participate in ECDL courses, which consist of 4 times 20 hours of lectures (Operating System, Word, Excel and PowerPoint), practice tests and the test itself. ECDL as an internationally recognised standard of computer literacy is a criterion for evaluating the performance of computer users. European Computer Driving Licence is a test of the knowledge of essential IT concepts, practical skills and competences, which confirms that the owner of the certificate is fully competent to use personal computer and basic software applications. Thank to the great success that ECDL had achieved in Europe, the program has been extended to the whole world under the title International Computer Driving License (ICDL) (<http://www.ecdl.org>).

The testing method itself was a combined method: candidates received their assignments on paper and

solved them on the computer. The testing lasted 45 minutes. Candidates could achieve a maximum of 32 points, where the minimum number of points for a positive result was 24 (75%). ECDL tests are standardised; the national holder of ECDL license for the territory of Serbia, Montenegro and Macedonia is JISA Unified IT Federation of Serbia. Based on the agreement with the ECDL Foundation, JISA is authorised to establishment of testing centres, promotion of the ECDL standard, verification of testing centres etc. (<http://www.ecdl.rs>). The testing was conducted in the test centre that is accredited under the name Consulting Here; the examiner was Zsolt Namesztovszki (authorization number: CS 0587J) in all cases.

Before starting the course, participants filled in a questionnaire where they provided answers to questions related to their age (birth date), the use of computers in their private life and at work, knowledge of English and education.

At the end of each module candidates were tested, the results of which were collected in a database with the results of the survey, and analysed with the help of statistical tools.

#### Population and research sample

584 ECDL course students took part in the project who live in different places in Vojvodina – North Backa, West Backa and North Banat (33 settlements).

The age of project participants ranged from 18 to 58. The average age was 31.42. This emerges from the fact that younger generations show more interest in ECDL courses.

Of the 584 participants 12 do not use a computer every day (2.05%). These candidates belong to the older generation (average age: 53.93).

12% (68 people) of participants reported that they have no basic knowledge of English, which would be necessary for understanding IT concepts.

Educational background of the sample is formed as follows:

- Primary school: 0.68% - 4 participants
- Three years of secondary school: 3.42% - 20 participants
- Completed a four-year secondary school: 18.49% - 108 participants
- Students: 31.51% - 184 participants
- Graduated in a college: 10.27% - 60 participants
- Graduated on a university: 32.19% - 188 participants
- Finished postgraduate studies: 3.42% - 20 participants

Types of jobs participants do:

- Students: 31.51% - 184 participants
- Work of administrative character: 28.08% - 164 participants
- Teachers: 12.33% - 72 participants
- Elementary school teachers: 10.27% - 60 participants
- Unemployed: 8.22% - 48 participants
- University lecturers: 6.16% - 36 participants
- Engineers: 2.74% - 16 participants
- Other: 0.68% - 4 participants

The reason for the large number of participants who perform work of administrative character emerges from the fact that an increasing number of employers requires a certificate, which is standardised and confirms the information literacy of the employees.

Pass rate was 95.89%, since 560 of 584 candidates passed the test and scored enough points. The average score was 28.44 (from 32), shown in percentage being 89.87%.

#### Analysis of empirical data

Starting from the research of the Statistical Office of the Republic of Serbia (Use of ICT in the Republic of Serbia, 2009), which clearly shows that younger generations - students apply computer the most (98.5% has applied it for the last 3 months), we have assumed that younger generations adopt IT concepts and improve IT skills more successfully.

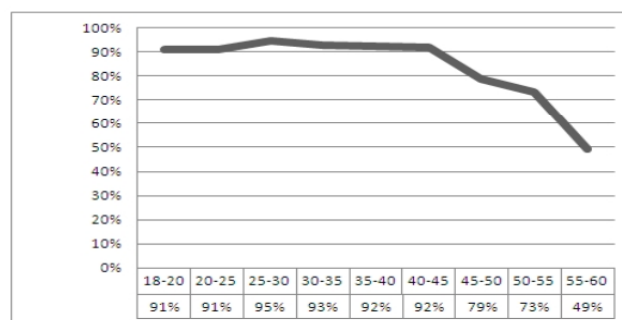


Figure 1. Performance on tests (ECDL standardised tests) in different age groups.

The next hypothesis was that daily use of computers at work or at home positively influences the adoption of IT concepts and skills. Those participants (12 participants - 2.05%) who have not used computers every day, gave up studying - without exception -, primarily due to the lack of basic competence and skills, (in their opinion) fast-



paced lecture, as well as the inability to practice on their own.

Knowledge of basic computer terminology in English is of great importance in the learning process. Statistical data have confirmed this assumption. Those candidates who have not known basic computer terms in English (12% - 68 candidates) had significantly lower scores in tests than the others. Candidates who knew English performed an average of 92.49% in the test, and those who did not know English had an average of 59.43%.

Analysing several factors and the performance of those participants who gave up the whole course (the reasons for that were always unbridgeable barriers in the learning process), we can state that these candidates did not know English, they did not use a computer on an everyday basis - they did not have a possibility to practice enough, and their average age was 46.93 years. The older group of candidates, who knew English and used computers daily, learnt specific content successfully.

Younger generation and middle-aged generation (under 45) who had university or college degree or were students, used computers on a daily basis and were familiar with basic computer terminology in English, were more successful (92.53%) than the average (88.88%) and than other research participants (81.84%).

As it is known, motivation is a prerequisite for successful learning. Since the candidates had volunteered (and paid) for the course, we assume that their level of motivation was on the appropriate level.

## V. CONCLUSIONS

Learning IT concepts and the learning process are the key issues of modern education. One of the main factors in this process is to build the ability of learning, so that the adopted IT concepts and developed IT skills can be flexibly used in new software (new versions of software) and hardware (other configurations) environment.

For successful adoption of IT contents, the most important factors are age, possessing a computer at home or at work and the knowledge of English. Beside motivation these are the key prerequisites of successful IT learning.

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