The 8th International Conference on Virtual Learning
VIRTUAL LEARNING – VIRTUAL REALITY

Phase II - Period 2010-2020: e-Skills for the 21st Century
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ICVL 2013 dedicated romanian mathematicians
Dimitrie Pompeiu and Gheorghe Țițeica: 140 years of the birth

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Phase II - Period 2010-2020: e-Skills for the 21st Century

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MOTTOS

„The informatics/computer science re-establishes not only the unity between the pure and the applied mathematical sciences, the concrete technique and the concrete mathematics, but also that between the natural sciences, the human being and the society. It restores the concepts of the abstract and the formal and makes peace between arts and science not only in the scientist' conscience, but in their philosophy as well."

Gr. C. Moisil (1906-1973)
Professor at the Faculty of Mathematics, University of Bucharest,
Member of the Romanian Academy,
Computer Pioneer Award of IEEE, 1996
http://www.icvl.eu/2006/grcmoisil

"Learning is evolution of knowledge over time"

Roger E. Bohn
Professor of Management and expert on technology management,
University of California, San Diego, USA,
Graduate School of International Relations and Pacific Studies
http://irps.ucsd.edu/faculty/faculty-directory/roger-e-bohn.htm

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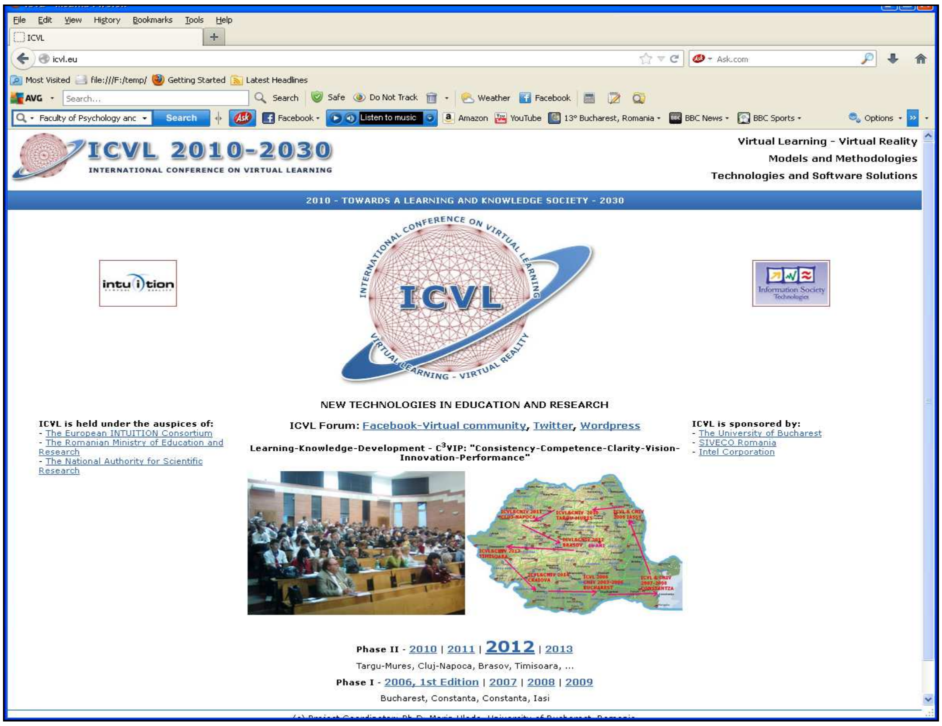
2010 – TOWARDS A LEARNING AND KNOWLEDGE SOCIETY – 2030
VIRTUAL ENVIRONMENTS FOR EDUCATION AND RESEARCH

C[3]VIP: "Consistency-Competence-Clarity-Vision-Innovation-Performance"



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Institutions: The Romanian Ministry of Education, University of Bucharest, Intel Company, SIVECO Romania

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Participate

The Conference is structured such that it will:

- provide a vision of European e-Learning and e-Training policies;
- take stock of the situation existing today;
- work towards developing a forward looking approach.

The Conference will consider the perspectives and vision of the i-2010 programme and how this will stimulate the promotion, and development of e-Learning content, products and services and the contribution of these to lifelong learning.

Participation is invited from researches, teachers, trainers, educational authorities, learners, practitioners, employers, trade unions, and private sector actors and IT industry.

Research papers – Major Topics

The papers describing advances in the theory and practice of Virtual Environments for Education and Training (VEL&T), Virtual Reality (VR), Information and Knowledge Processing (I&KP), as well as practical results and original applications. The education category includes both the use of Web Technologies, Computer Graphics and Virtual Reality Applications, New tools, methods, pedagogy and psychology, Case studies of Web Technologies and Streaming Multimedia Applications in Education, experience in preparation of courseware.

Thematic Areas / Sections

- **MODELS & METHODOLOGIES (M&M)**
- **TECHNOLOGIES (TECH)**
- **SOFTWARE SOLUTIONS (SOFT)**
- **"Intel® Education" – Innovation in Education and Research (IntelEdu)**

Objectives

2010 – Towards a Learning and Knowledge Society – 2030

Relevant topics include but are not restricted to:

- National Policies and Strategies on Virtual Learning
- National Projects on Virtual Universities
- International Projects and International Collaboration on Web-based Education
- Dot-com Educational Institutions and their Impact on Traditional Universities
- Educational Portals for education and training
- Reusable Learning Objects for e-Learning and e-Training
- Testing and Assessment Issues of Web-based Education
- Academia/Industry Collaboration on Web-based Training
- Faculty Development on Web-based Education
- Funding Opportunities for Projects in Web-based Education

Learning and the use of Information and Communication Technologies (I&CT) will be examined from a number of complementary perspectives:

- **Education** – supporting the development of key life skills and competences
- **Research** – emerging technologies and new paradigms for learning
- **Social** – improving social inclusion and addressing special learning needs
- **Enterprise** – for growth, employment and meeting the needs of industry
- **Employment** – lifelong learning and improving the quality of jobs
- **Policy** – the link between e-Learning and European / National policy imperatives
- **Institutional** – the reform of Europe’s education and training systems and how I&CT can act as catalyst for change
- **Industry** – the changing nature of the market for learning services and the new forms of partnership that are emerging

General Objectives

The implementation of the Information Society Technologies (IST) according to the European Union Framework-Programme (FP7)

- The development of a Romanian Framework supporting the professional and management initiatives of the educational community.
- The organization of the activities concerning the cooperation between the educational system and the economical companies to find out an adequate distribution of the human resources over the job market.
- To promote and implement the modern ideas for both the initial and continuing education, to promote the team based working, to attract and integrate the young graduates in the Research and Development projects, to promote and implement IT&C for initial and adult education activities.

Particular objectives

The development of Research, projects, and software for E-Learning, Software and Educational Management fields

- To promote and develop scientific research for e-Learning, Educational Software and Virtual Reality
- To create a framework for a large scale introduction of the e-Learning approaches in teaching activity.
- To assist the teaching staff and IT&C professionals in the usage of the modern technologies for teaching both in the initial and adult education.
- To improve the cooperation among students, teachers, pedagogues, psychologists and IT professionals in specification, design, coding, and testing of the educational software.
- To increase the teachers' role and responsibility to design, develop and use of the traditional technologies and IT&C approaches in a complementary fashion, both for initial and adult education.
- To promote and develop information technologies for the teaching, management and training activities.
- To promote and use Educational Software Packages for the initial and adult education.

Thematic Areas/Sections

Models & Methodologies (M&M):

- Innovative Teaching and Learning Technologies
- Web-based Methods and Tools in Traditional, Online Education and Training
- Collaborative E-Learning, E-Pedagogy,

- Design and Development of Online Courseware
- Information and Knowledge Processing
- Knowledge Representation and Ontologism
- Cognitive Modelling and Intelligent systems
- Algorithms and Programming for Modelling

Technologies (TECH):
- Innovative Web-based Teaching and Learning Technologies
- Advanced Distributed Learning (ADL) technologies
- Web, Virtual Reality/AR and mixed technologies
- Web-based Education (WBE), Web-based Training (WBT)
- New technologies for e-Learning, e-Training and e-Skills
- Educational Technology, Web-Lecturing Technology
- Mobile E-Learning, Communication Technology Applications
- Computer Graphics and Computational Geometry
- Intelligent Virtual Environment

Software Solutions (SOFT):
- New software environments for education & training
- Software and management for education
- Virtual Reality Applications in Web-based Education
- Computer Graphics, Web, VR/AR and mixed-based applications for education & training, business, medicine, industry and other sciences
- Multi-agent Technology Applications in WBE and WBT
- Streaming Multimedia Applications in Learning
- Scientific Web-based Laboratories and Virtual Labs
- Software Computing in Virtual Reality and Artificial Intelligence
- Avatars and Intelligent Agents

Topics of interest include but are not limited to:

Virtual Environments for Learning (VEL):
- New technologies for e-Learning, e-Training and e-Skills
- New software environments for education & training
- Web & Virtual Reality technologies
- Educational Technology and Web-Lecturing Technology
- Advanced Distributed Learning (ADL) technologies
- Innovative Web-based Teaching and Learning Technologies
- Software and Management for Education
- Intelligent Virtual Environment

Virtual Reality (VR):
- Computer Graphics and Computational Geometry
- Algorithms and Programming for Modeling
- Web & Virtual Reality-based applications
- Graphics applications for education & training, business, medicine, industry and other sciences

- Scientific Web-based Laboratories and Virtual Labs
- Software Computing in Virtual Reality

Knowledge Processing (KP):
- Information and Knowledge Processing
- Knowledge Representation and Ontologism
- Multi-agent Technology Applications in WBE and WBT
- Streaming Multimedia Applications in Learning
- Mobile E-Learning, Communication Technology Applications
- Cognitive Modelling, Intelligent systems
- New Software Technologies, Avatars and Intelligent Agents
- Software Computing in Artificial Intelligence

Education solution towards 21st Century challenges (IntelEDU):
- Digital Curriculum, collaborative rich-media applications, student software, teacher software
- Improved Learning Methods, interactive and collaborative methods to help teachers incorporate technology into their lesson plans and enable students to learn anytime, anywhere
- Professional Development, readily available training to help teachers acquire the necessary ICT skills
- Connectivity and Technology, group projects and improve communication among teachers, students, parents and administrators

S e c t i o n

MODELS & METHODOLOGIES

Models and Methodologies (M&M):

- Innovative Teaching and Learning Technologies
- Web-based Methods and Tools in Traditional, Online Education and Training
- Collaborative E-Learning, E-Pedagogy,
- Design and Development of Online Courseware
- Information and Knowledge Processing
- Knowledge Representation and Ontologism
- Cognitive Modelling and Intelligent systems
- Algorithms and Programming for Modelling

"Didactica Nova" – a Challenge for the Academic Curriculum

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Abstract

The concept of "totally alienated students" has evolved, in the last 40 years, focusing our attention towards what we can call "alienated education practices". Lately, higher education institutions are getting visible results in their efforts to raise the quality of the education process by implementing various measures to determine students to be active participants in their own learning. Celebrating 150 years since its establishment, the University of Bucharest launched a challenge for the academia, calling for innovation in the curriculum design and delivery. It aims to foster an update in the curricula, in order to improve the teaching methods and the learning process in Romanian universities. The declared objectives of the project are oriented towards promoting a continuous improvement of the teaching methods to match younger generations' changing profile. Specific arguments are presented in the article, in an attempt to build the basis for a theoretical construction with meaningful applications to be used in the next academic year.

Keywords: Higher education, education practices, academics, new methods of teaching and learning

Introduction

The (higher) education environment comprises four main elements: the student, the teacher, the content of learning, and the didactic strategies. In order to fulfil its functions, these components "must serve, complement and derive meaning from each other" [1], in other words, the requirement of "curriculum alignment" to be correctly calibrated. ICTs are coming to assist and bring into attention the shift towards the critical role universities are envisaging: quality education. Mainly brought into institutional policy documents as an imperative, but left at the abstract level due to the ICTs' scatter on various usage benefits and to their relative novelty, the task of ICTs integration into education activities resides in the pool of educators' roles and competencies.

In the context of integration of higher education graduates in the labour market and in the dynamic professional activities of present times [4], the professor should improve teaching, to adapt the teaching methods in order to avoid learning by memorization, bearing in mind the continuous assessment of learning outcomes, and developing higher-order thinking skills and competencies such as student autonomy, critical thinking, problem solving, teamwork. In turn, students must have an active participation in all educational and collaborative activities that are required, to show solidarity within those work teams that require complex efforts. [2]

Better educators, better students. Towards bettering higher education practices

In defining a new framework for an adequate academic curriculum, the main assumption is that students today are different from students 20 years ago. Some authors even talk about a "different mind" of young people today and a different attitude towards knowledge acquisition and skills development. More and more, the concept of "totally alienated students", used for the first time 40 years ago [1], would gain in significance without university coordinated efforts to improve the education environment and to adequate it to the cultural, technological and social realities nowadays. In addition, “a professional approach to teaching and educational management will end the mythic orientation and the unavoidable improvisations. Vicinity with artistry and giftedness doesn’t seem to offer nowadays the desire perspective on the teaching profession.” [3]

Controlling the conditions in which learning occurs is not the only condition – it is also about creating an appropriate cultural climate for preparing authentic professionals of the (near) future. Some key elements are described as it follows, regarding the professors’ activity and the students’ (expected) behaviour [2] [5] [6].

Professors’ behaviour

Teaching Style. Theory and applications

The teaching style and the approach of theory and practical applications must motivate students to participate actively and with pleasure in learning activities. Professors should replace monotonous lectures, possibly with a dialogue that he/she launches for students during a course or class. Course content must include both theory (concepts, terms, methods, techniques etc.) and, most important, applications and practical examples for the acquisition of knowledge and skills. The share between theory and practice will be reflected in the final assessment.

Competency-oriented content

The course content and the teaching activities will target students' ability to act in solving various problems through encouragement of: critical thinking, logical thinking, experimentation and creativity, project work and teamwork. The university professor must adapt the methods to determine students to eliminate ”learning by heart”, inefficient and tedious activities. For deep learning, specialists in pedagogy are recommending that the educator describes, for each concept, evolution, history and its role in the context of the theory studied; in this way, students can understand more clearly the concepts they need to apply.

Interactivity in presentation and dialogue

Presenting a course must be done through active means – using, where appropriate, PowerPoint-type slides or Prezi, simulations of processes, the use of specialized software, representations, etc. – in order to favour an interactive approach of the content and to determine students to participate in a dialogue in which they can help with ideas on topics. Contrary to the habits of teaching through lectures, it is much more an effective method by which students are invited by the teacher to ask questions on topics discussed and explained in class.

Teaching and deep learning

University teachers must act as co-learners, to determine appropriate methods on-the-way, and to be able to continuously assess learning effectiveness. It is recommended that students which have difficulties in solving learning tasks to be assisted to overcome moments of misunderstandings regarding theory and practical applications.

Student’ behaviour

Motivation and learning

Students must have an ongoing concern in finding the motivation to attend classes and all learning activities arising from the curriculum. Family and faculty staff should help them be receptive to learning tasks and to actively participate in solving practical applications.

Active participation and solidarity

Consulting and regularly using educational resources recommended by a professor for both theory and practical applications would increase students’ capacity to cover the curriculum and the development of skills required for active professionals. Students must have an active participation in all collaborative activities that are required, showing solidarity within team members in tasks requiring complex efforts. They must actively contribute in eliminating misconceptions through efforts in correctly formulating problems, tasks, (investigative) questions when they are in dialogue with educators or peers.

Systematic training and professional ethics

Creating a learning behaviour to determine a constant concern for competencies development and knowledge acquisition could be acquired by weekly participation in all the duties of the academic curriculum and by continuously preparing for regular systematic assessments. Intolerance for fraud of any kind, combined with a special respect for faculty staff and colleagues are means towards development of authentic professionals of tomorrow.

These recommendations are only the top of the iceberg, being empowered through a meaningful institutional concern for quality assurance. “Schizophrenic educational environments” [3] and alienated education practices cannot be avoided without mechanisms assumed by both institutions and each institutional actor, without trust, confidence and day-by-day commitment towards education.

A mean to boost innovation: a contest for education improvement

During the 2013-2014 academic year, the Faculty of Psychology and Education Sciences is organising the competition "Didactica Nova", celebrating 150 years since the establishment of the University of Bucharest in 2014. The contest theme refers to an innovative academic curriculum: conception, design, development and promotion of digital academic resources. Digital university courses are required to have a new design and to embed teaching methods appropriate for younger generations.

The initiative for this action is aiming to motivate, stimulate and mobilize academics towards the use of new technologies and computer in higher education, towards employing appropriate and innovative teaching methods when working with nowadays’ younger generations. Stated objectives requires individual and collective responsibility, improved educational actions and approaches, as an invitation for students to be active participants in their own learning, as a call for using technology as mediator of quality education, in the light of the new role of forming new perspectives on education, research and innovation.

The contest is a way to challenge the academic staff of Romanian universities towards changes regarding not only the curriculum process, but as well concerning the networking and participation abilities, their capacity to collaborate with private sector and to learn from relevant practices how to improve their presence and influence in the labour market and in the life of their direct beneficiaries, to “encourage and establish practices for transversal and horizontal learning” [3].

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On Developing Virtual Reality Applications Using the *Scilab* Environment

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Abstract

Various technical, business and social oriented applications require a powerful environment supporting interoperability over the web. Optimized solutions are necessary not only for economically point of view but also for entertainment. This paper illustrates a large plethora of techniques based on ***Scilab*** *environment to implement virtual reality applications for education. Modelling and simulation aspects, programming techniques and graphical visualization practices are some of the topics under discussion. Practical examples illustrates the power of* ***Scilab*** *for developing a large class of virtual reality applications.*

Keywords: *Scilab*, Modelling and Simulation, Virtual Reality, Virtual Learning

Introduction

The interest for open source software is increased nowadays not only by business point of view, but also for its increasing reliability. *Scilab* is such a trustable software project.

Initially, *Scilab* was devoted to matrix operations in order to support scientific and engineering applications. As Scilab enterprises (2013) outlines, the researcher is able to extend the environment by adding new *Scilab*-coded or hard-coded functions. *Scilab* functionalities can be extended by calling **Java**, **Python**, **TCl**, **FORTRAN** or **C/C++** components. In this way, the *Scilab* environment offers many components to facilitate the reusing of previously developed code and applications. All *Scilab* features can be called by external applications. To meet the user's needs, connectors are available for Java, Python and C/C++. Also, *Scilab* can be called from some popular applications (like: **Excel**, **LabVIEW**, **Isight** – intercommunication with *Dassault Systèmes flagship software*, **ProActive** – *to support parallel, distributed and multi-core computing*, and **DIET** – *the* ***Scilab*** *tasks can be distributed over Grids or Cloud platforms*) through dedicated modules, gateways or inner components.

This paper investigates on the possibility of choosing *Scilab* for teaching classes in developing virtual reality applications according to the requirements specified in Albeanu (2006).

In the following, the *Scilab* environment capabilities are outlined (next section) and some virtual reality applications developed with or in connection to *Scilab* will be presented in the third section.

The Scilab environment

Scilab is an open source freeware software environment for numerical computing and scientific visualization being composed of three distinct parts: an interpreter, libraries of functions and *Scilab* procedures, and libraries of FORTRAN and C routines. As described by developers, in Scilab Enterprises (2013), the basic functionalities of *Scilab* are described in Table 1. Moreover, external modules can add functionalities to *Scilab* in several applications domains. Some modules are shown in Table 2.

Scilab expressions are evaluated by the interpreter which is able to recognize a large set of entities. A *Scilab* object is a basic object or a set of basic objects arranged in a vector, a matrix (one-or-two dimensional arrays), a hyper-matrix (multidimensional matrices), or a structure (list). The objects have dynamic type and are resized according to some operators and functions. According to Baudin (2011) and Scilab enterprises (2013), there is no explicit object declaration as in other programming languages like Pascal, C, C++, Java etc.

Scalars and the elements of vectors and matrices can be real or complex. Double-precision floats are used during computation according to IEEE 754 standard. The standard *Scilab* environment support also string matrices, Boolean matrices, sparse matrices, integer matrices with components of size 8, 16 or 32, polynomial matrices, and rational matrices.

Vectors and scalars are stored as matrices as in *Matlab* (Riesch(2010), Sharma & Gobbert (2010)). The two-dimensional arrays are stored in column order. The matrix construction operators address both row (;) and column (,) concatenation operations.

Lists are *Scilab* data objects and can have one of the following structures: ordinary lists - behaving like *Matlab* cell vectors (one-dimensional cell arrays), typed lists, and matrix-oriented typed lists.

Table 1. *Scilab* basic functionalities

Field	**Short description**
Maths & Simulation	Engineering and science applications including mathematical operations and data analysis are excellent supported.
2-D & 3-D Visualization	There are available graphics functions to visualize, annotate and export data and many ways to create and customize various types of plots and charts.
Optimization	*Scilab* provides a large set of algorithms to solve constrained and unconstrained continuous and discrete optimization problems.
Statistics	Valuable tools to perform data analysis and modelling are available in *Scilab*.
Control System Design & Analysis	There are ready to be used standard algorithms and tools for control system study.
Signal Processing	Provides tools to visualize, analyze, and filter signals in time and frequency domains.
Application Development	Native functionalities and data exchanging ways can be increased using external tools.
Xcos - Hybrid dynamic systems modeller and simulator	A tool for modelling mechanical systems, hydraulic circuits, and control systems is available.

Table 2. Some *Scilab* modules

Field	**Modules**
Development	**LCC-Windows** - LCC-win32 support for *Scilab*; **MinGw** - Dynamic link with MinGW for *Scilab* on Windows
Education	**CPGE** - Dedicated Xcos blocks for preparatory classes for the *grandes écoles*, **Module Lycée** - Scilab for high schools
Graph	**Metanet** - Graph and Network toolbox
HPC	**sciGPGPU** - Gpu Computing for Scilab
Interconnection	**DDE** - Dynamic Data Exchange client for *Scilab*, **JIMS** – Java Interaction Mechanism in *Scilab*, **Modbus** - Modbus Interface
Optimization	**Quapro** - Linear and Linear Quadratic Programming
Modelling and Control Tools	**DACE** - Scilab Kriging module, **RLTOOL** - A GUI toolbox for designing Single Input Single Output systems,

Aerospace	**CelestLab** - CNES Space mechanics toolbox for mission analysis, **Aerospace Toolbox** - A toolbox for aerospace engineering, **Aerospace Blockset** – provides basic aerospace blocks based on CelestLab library.
Graphics and Image Processing	**Plotting library** - *Matlab*-like plotting library, **SIP** - *Scilab* Image Processing Toolbox, **Image Processing Design Toolbox** (IPD) - implements functions for object detection, **SIVP** - image processing and video processing tasks, **CGLAB** – Computational Geometry Algorithms Library etc.

Over time, many basic objects, and special functions were designed and incorporated by *Scilab* and now, the researchers have a powerful tool useful for a large plethora of applications: signal/image/video processing (Fabbri et al.(2012), Ramachandran (2012), modelling and simulation (Bordeianu et al.(2009), Campbell et al. (2010), Colette et al. (2013), INRIA(2013)), humanoid motion analysis (Wieber(2006), INRIA(2006)), virtual laboratories (Magyar et al., 2010), intelligent data processing (ATOMS(2011), Shao (2009)), research and teaching (Sharma & Gobbert (2010), Jagdish et al. (2012)), and virtual reality applications using VRScilab (XMU Scilab Group, 2003) and tools developed by various groups supporting the exchange of digital assets like: COLLADA, X3D, VTK etc. The availability of tools like *GetFEM++* (Colette et al., 2013) makes possible the solving of such models as those described in Liu, P.L.-F., Yeh, H. and Synolakis, C (2008).

Virtual Reality projects

According to Craig et al. (2009), virtual reality (VR) refers to “a computer simulation that creates an image of a world that appears to our senses in much the same way we perceive the real world or ‘physical’ reality”. Multimedia and VR are “really technologies that extend the earlier generation of graphical user interfaces with a richer set of media, 3Dgraphics to portray interactive worlds, and more complex interactive devices that advance interaction beyond the limitations of keyboards and the mouse”, as Sutcliffe (2003) says. As Craig et al. (2009) proved, scientists have interacted with their work by virtual reality in three primary ways: “the visualization of observed and simulated data” (the field of scientific visualization), “exploration of places that are difficult to travel to” (the field of scientific exploration), and “direct interaction with simulations of physical systems” (the field of physical system simulation and interaction).

Creating virtual environments or visualizing results of simulation models requests special capabilities like signal processing to support sound effects, image and video creation and processing. In the following such functionalities provided by *Scilab* and their application along some virtual reality projects will be presented.

First of all, the main interest is to create graphical user interfaces (GUI) for the applications. *Scilab* provides adequate functions to manage GUI objects: scf (to set the current graphic figure (window)), uicontrol (to create an object in a figure), uimenu (to create a menu or a submenu in a figure), and many others.

Loading and saving signals or only small portions of lengthy signals that are to be used or are to be generated are supported by *Scilab* (by the functions load, save, read, and write). Also, the generation of synthetic (random) signals is permitted. Signal processing makes use of rational polynomials to describe signal and system transfer functions representing continuous time signals or systems or discrete time signals or systems. Filtering of signals by linear systems (or computing the time response of a system) is done by the function flts from CASCD (*Scilab*'s control package).

The following basic image processing operations, available in ***I**mage **P**rocessing **D**esign Toolbox* (IPD), are useful in research and virtual environment modelling: thresholding, blob analysis, filtering (linear, median, and morphological), watershed transform, and distance transform.

Geometric modelling is also supported by *Scilab*. The current version of the **CGLAB** toolbox provides a collection of functions, the most important being related to Delaunay triangulations in

2D, 3D and *n*D space, and convex hull in 2D and 3D. The following geometrical primitives are available: rectangle, ellipse, arc, pie, polyline, polygon, 2D and 3D plots (curves, surfaces), histogram, spline (curves and patches), text and axis. *Scilab* support geometrical transformations like: move, scale and rotate, and appearance transformations by colour management functions.

Scilab uses a Swing OpenGL component to display graphics. Fully integrated within the *Scilab*'s Swing UI, the plotting module is based on JOGL, and benefits of the OpenGL accelerated graphics. Starting with Java SE 6 version, Java2D (the API for drawing two dimensional graphics in Java) and JOGL have become interoperable, and provide new powerful tasks on top of OpenGL rendering: overlaying Swing components, drawing 3D OpenGL graphics, the usage of 3D graphics anywhere where ordinarily a Swing widget is used, and drawing Java2D graphics on top of 3D OpenGL rendering.

There are many teams working on *Scilab* extension with powerful modules. The success of *Scicos* is well known. Other projects demonstrate already the power of *Scilab* and new projects are under development. In the following, the most important features of these projects are outlined.

GreenLab: GreenLab is a Functional Structural Plant Model (FSPM), which builds the plant morphogenesis using algorithms that simulate both the organs production (plant development) and the biomass production (plant growth), consisting of two modules (Hu et al., 2003). The first module, namely "Growth Engine Model" is responsible with both structural and functional models of plant growing. The second module, namely, "3D Visualization Model" prepares the output from geometric, texture, light and rendering models. GreenLab model is implemented by GreenScilab software.

HuMAnS (a homogeneous framework for motion capture, analysis and simulation): This toolbox is developed with *Scilab* and implements state of the art algorithms for modelling (kinematics, kinetics, and dynamics of human bodies), analysis and simulation of human and humanoid motion (Wieber et al., 2006). The model generation uses **Maple** to generate C language code. **Maple** and a **C** compiler are required during creation of new models or modification of those already included in HuMAnS.

Siconos (software for modelling and simulation of non-smooth dynamical systems): Four packages (kernel, numerics, front-end, examples) form the full toolbox. There are six C++ classes to deal with Dynamical Systems (one class is an abstract one being the base class, the remaining classes cover the following type of systems: first order general non linear systems, first order linear systems, first order linear system with time-invariant coefficients, second order non linear Lagrangian system, and second order linear systems with time-invariant coefficients). There are two ways to run a simulation with Siconos: directly with a C++ input file or using a specific interface (Python, Scilab).

VRScilab: VRScilab is a VRML add-in toolbox designed to work with *Scilab*. VRScilab exports *Scilab* 3-D graph in VRML format (http://vrscilab.sourceforge.net/).

Scilab scenes/graphics can be exported to X3D, VTK, and Collada format. New modules are under development in the framework of GSOC project.

Conclusions

Scilab is a powerful framework with very good capabilities for modelling and simulation, including for virtual reality scientific applications. Due to the JOGL interface, *Scilab* can be used for other applications (serious games, educational software etc.).

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On the Development of a General Educational Ontology for University Didactical Activities

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Abstract

The development of a web-based education requires the use of educational ontologies. Knowledge sharing between teachers and students is facilitated by using concepts defined in such ontologies. Any didactical activity from a university has three main phases: teaching, learning and examination. During each phase run specific models, methods, techniques, approaches, and styles are used, most of them being related to those used in the other two phases. In this context, the improvement of the whole didactical activity can be more effective if the educational ontologies include apart from the pure theoretical and technical course domain dependent concepts, some course independent concepts (e.g. from the pedagogical, methodological and psychological web-based educational views). Examples of such concepts are the teaching style, teaching method, learning style, student model, examination method and so on. The paper proposes a general educational ontology for university didactical activities, based on the guidelines of the EduOntoFrame educational ontology development framework.

Keywords: Educational ontology, Web-based education, Knowledge representation

Introduction

The importance of using ontologies in the university educational systems was increased by the new modalities of doing a computer and network-based higher education (as e.g. web-based education, e-learning platforms, virtual laboratories, collaborative educational and research networks, virtual educational environments). Ontologies provide a solution for solving the knowledge representation problem, and the interoperability of the systems [7]. An educational ontology can be defined as an ontology specific to the instructional process. Knowledge sharing between teachers and students is facilitated by using terms and concepts defined in such ontologies. A variety of educational ontologies were reported so far in the literature (see e.g. [1], [2], [3], [4], [5], [6], [8], [12]), each of them using particular development frameworks or methodologies. Educational ontologies can model a course for all three phases of a didactical activity: teaching, learning and examination. An educational ontology has general concepts and terms for any course, and specific concepts and terms for the knowledge domain of the current course. We have analyzed in [9] the use of educational ontologies as support tools for didactical activities, and we have proposed in [10] a general framework, EduOntoFrame, for educational ontologies development. During each didactical activity phase run specific models, methods, techniques, approaches, and styles are used, most of them being related to those used in the other two phases. The improvement of the whole didactical activity can be more effective if the educational ontologies include apart from the pure theoretical and technical course domain

dependent concepts, some course independent concepts (e.g. from the pedagogical, methodological and psychological computer-based educational views). Examples of such concepts are the teaching style, teaching method, learning style, student model and examination method. In this paper we propose a general educational ontology for all three university didactical activities of teaching, learning and examination.
The paper is structured as follows. In section 2 it is briefly presented the EduOntoFrame educational ontology development framework. A general educational ontology for university didactical activities is proposed in section 3. The final section concludes the paper.

The EduOntoFrame educational ontology development framework

We have started the design of the EduOntoFrame educational ontology development framework from the basic idea that any didactical activity follows a similar design pattern for each of the three activities, teaching, learning and examination. Figure 1 shows a general view of a full didactical activity cycle. During the phases of the didactical activity some course specific educational resources are used, each resource being based on the educational ontologies that include course specific ontologies and prerequisite courses specific ontologies.

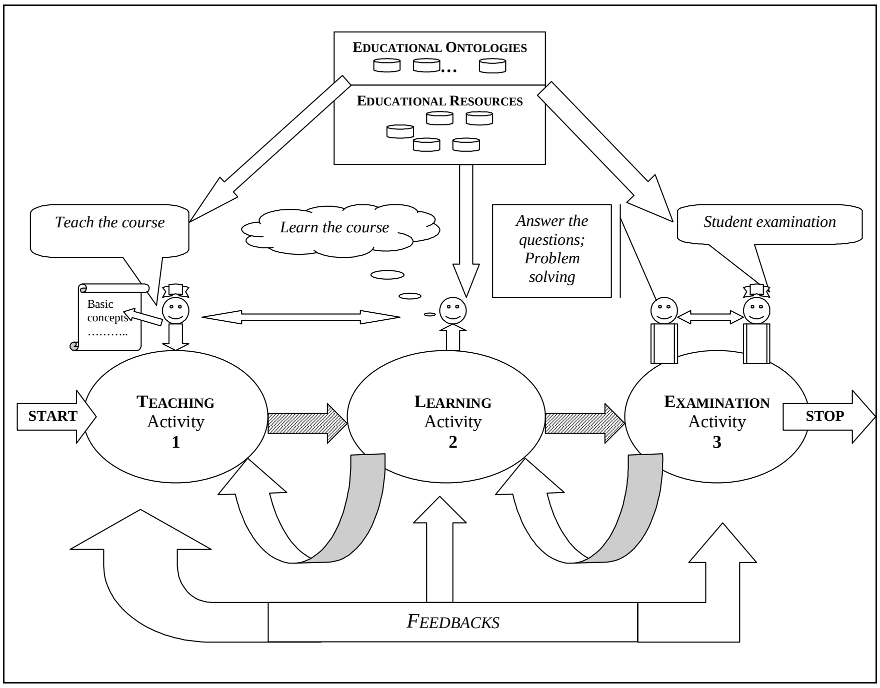

Figure 1. A general view of the full didactical activity cycle.

In the EduOntoFrame general framework eight educational ontologies are generated, five course dependent ontologies (Course Basic Subject Ontology, Course Advanced Subject Ontology, Course Prerequisite Subject Ontology, Course Practical Activities Ontology, Course Examination Ontology), and three course independent ontologies (Basic Teaching Ontology, Basic Learning Ontology and Basic Examination Ontology). The last three ontologies are the core ontologies that will form a general educational ontology with concepts from the used educational, pedagogical, methodological and psychological didactical models.

The general framework for educational ontologies development, EduOntoFrame, is given as follows, under the form of a generic algorithm.

/**/
ALGORITHM *EduOntoFrame – A General Framework for Educational Ontologies Development*
Input: *course, prerequisite courses, student, teacher*
Output: *Educational Ontologies* for the *course* and specific *student competences*

Begin

1. **do** *Teaching Activity Ontologies Generation* // for the teaching activity
/* generate the following ontologies:
Course Basic Subject Ontology (BS),
Course Advanced Subject Ontology (AS),
Course Prerequisite Subject Ontology (PS),
Basic Teaching Ontology (BT); // includes teaching models
*/

2. **do** *Learning Activity Ontologies Generation* // for the learning activity
/* generate the following ontologies:
Course Practical Activities Ontology (CPA),
Basic Learning Ontology (BL); // includes learning models
*/
3. **do** *Examination Activity Ontologies Generation* // for the examination activity
/* generate the following ontologies:
Course Examination Ontology (CE),
Basic Examination Ontology (BE); // includes examination models
*/
End.
/**/

Figure 2 shows the educational ontologies generated by the EduOntoFrame general framework.

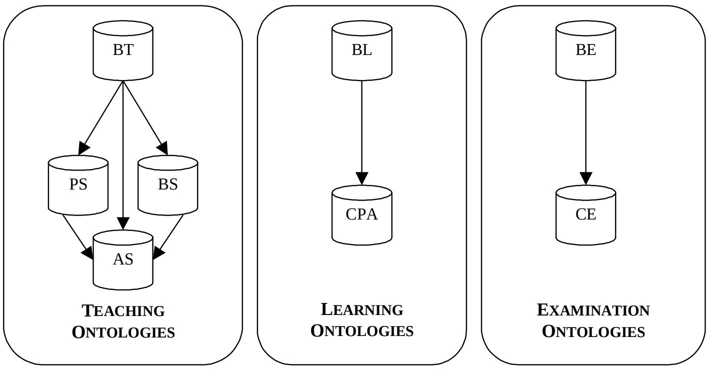

Figure 2. The educational ontologies generated by the EduOntoFrame general framework.

The general educational ontology for university didactical activities
The educational ontologies include general and course specific terms for all three stages of the didactical activity. A term can be a concept, a property or a relationship. Some of the terms are

course domain independent, and are basic notions for any didactical activity performed in a university (e.g. curriculum, syllabus, teaching model, teaching style, teaching method, teacher competences, course structure, pedagogical role, pedagogical resource, knowledge resource, research resource, student model, learning style, learning method, student knowledge level, student research ability, student examination method, teaching feedback, learning feedback, examination feedback). Among these terms some are specific to the pedagogical, methodological and psychological views adopted for the full didactical activity, especially when the education method is adapted to the student capabilities and student performances expectations, which are different for the main categories of students from a university: undergraduate, postgraduate, MSc and PhD students.

We have grouped all terms that are course domain independent in a general educational ontology. Basically, this is composed by the three course independent ontologies generated with the EduOntoFrame general framework (i.e. Basic Teaching Ontology, Basic Learning Ontology and Basic Examination Ontology). Figure 3 shows the structure of this general educational ontology.

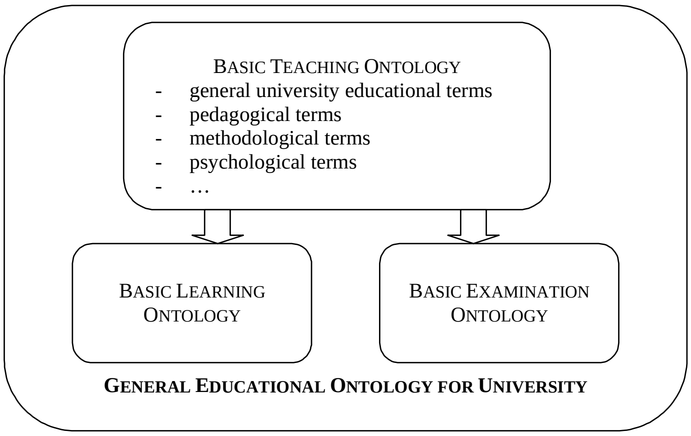

Figure 3. The structure of the general educational ontology.

The Basic Teaching Ontology contains terms specific to any teaching activity performed in a university (e.g. general university educational terms, pedagogical terms, methodological terms, psychological terms). Examples of such terms are: pedagogical role, pedagogical resource, knowledge resource, teaching model, teacher-directed model, student-directed model, adaptive teaching, teacher competences, teaching style, interactive teaching, social teaching, teaching feedback, teaching tools, teaching goals, course description (title, duration, structure, curriculum, syllabus, target audience), course content (educational unit, prerequisite knowledge, course chapter, sub-chapter, module, sub-module, section, sub-section), course resource (software resource, hardware resource, research resource, course presentation, course tutorial, lecture notes and readings, textbook, references, course document file such as ASCII text, doc, html, audio, video, slide, pdf, ps, PowerPoint file etc).

The Basic Learning Ontology contains terms specific to any learning activity: student model, student knowledge stereotypes, beginner, average, advanced, expert, learning method, adaptive learning, learning styles, active reflective, sensing intuitive, visual verbal, interactive learning, student learning feedback, learning goals, practical activity, research activity, experiments, applications, student competences, learning object, resource, lessons learned etc.

The Basic Examination Ontology contains terms specific to any examination activity of an instructional process. Examples of terms are: examination method, written examination, oral examination, written and oral examination, computer-assisted examination, student knowledge level, student research ability, examination feedback, assessment, self-assessment, assessment items, exercises, individualized exercises, questions, tests, problems, theoretical problems, practical problems, research experiments and analysis, student synthesis capacity, student analysis capacity etc.

Figure 4 presents a selection from the general educational ontology hierarchy.

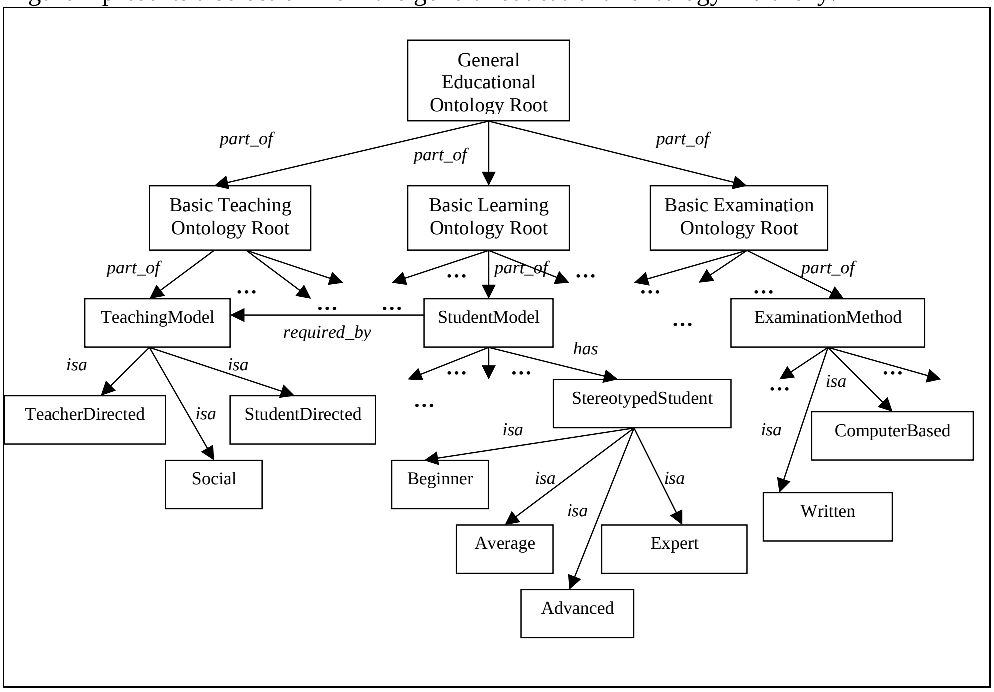

Figure 4. The general educational ontology hierarchy (selected ontology subtrees).

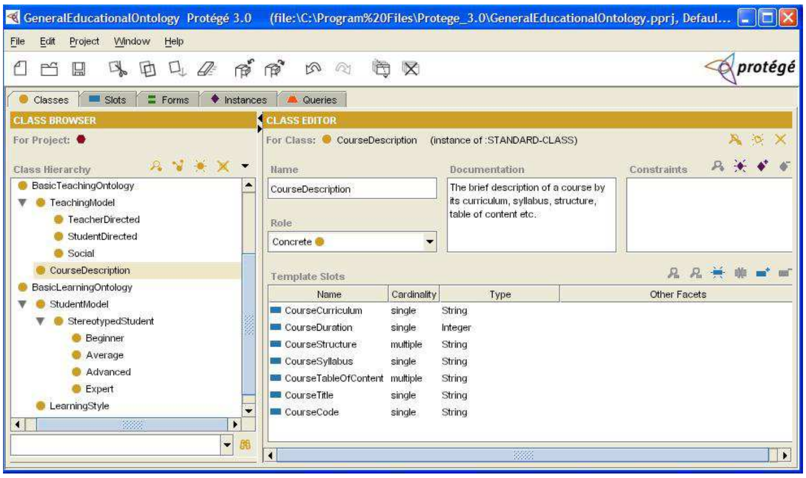

Figure 5. A screenshot with some classes of the general educational ontology for university didactical activities (in Protégé 3.0).

The vocabulary of the general educational ontology contains all basic terms specific to teaching, learning, and examination activities. The definition of the ontology involves apart from concepts identification and definition (i.e. vocabulary representation), the specification of the relationships between the concepts, and of the axioms that state the rules of using the terms in proper ways. Examples of relationships used by the ontology are as follows: *is_a*, *ako* (a kind of), *has*, *part_of*, *order*, *required_by* etc.

In Figure 5 it is shown a screenshot with some classes of the general educational ontology implemented in Protégé 3.0 [11], a Java-based ontology editor.

The general educational ontology can be used by the main actors of the instructional process, teachers and students through various computer or network-based higher educational systems such as the e-learning platforms, web-based educational systems, collaborative educational and research networks or virtual educational environments, during the university didactical activities of teaching, learning and examination.

Conclusion

The paper proposed a general educational ontology for university didactical activities (teaching, learning, examination), based on the guidelines of the EduOntoFrame educational ontology development framework. The ontology can be extended with new concepts specific to educational knowledge (including pedagogical, methodological and psychological knowledge). Also, it can be adapted to particular types of teaching, learning and examination approaches.

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Adult Students' Level of Confidence and performance in a GBL activity - Are military students overconfident?

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Abstract

Game Based Learning (GBL) is an increasingly used methodology in adult formal education, the use of which is also expanding in the military context. Since the first military and pilot simulations were introduced, a variety of GBL elements have been implemented for training. Nevertheless, trivia games and multiple-choice GBL tasks may lack of significant learning outcomes, as students in these learning activities tend to use the "trial and error" technique. In this context we propose MetaVals, a personalized collaborative GBL activity designed to allow students share performance and Level of Certainty (LC) in order to minimize the "trial and error" answers, by guiding the participants to the reflection and sharing of their knowledge and their LC during the gameplay. The implementation of MetaVals in Carol I University among a group of adult military students is presented as a continuation of an experience started in 2012 and repeated in 2013 and its results are discussed as such, showing both a comparison for some in-process approaches but also the improvement perceived in the results. In relation to LC and performance, participants face the GBL activity as useful and engaging for training their skills in English terminology. Furthermore, data show higher performance of the group in the collaborative phases of the game (2013 experience) compared to the individual stage (2012 experience). Concerning LC, students in the sample tend to be overconfident and accurate in their answers, and stick to their own LC during discussion with dyad-mate. Furthermore, military students appear to have a high LC. Future studies in greater samples, comparing with non military students are proposed, in order to have a solid base for implementing LC sharing tools in GBL, as this has been shown to bring performance improvement in this context.

Keywords: GBL, Collaboration, Level of Confidence, Military, MetaVals

1 Introduction and Theoretical background

Game Based Learning (GBL) is defined as an active learning methodology allowing participants to be introduced in a certain field. Games and simulations have an important role in adult education and training, as they can put learning into a context (Leemkuil, de Jong, de Hoog and Christoph, 2003). According to Burgos, Tattersall and Koper (2007), teachers are more and more interested in games for educational purposes: games can provide students with specific content and skills in a friendly, save environment. Furthermore, GBL in general, and collaborative GBL in particular have the potential to transform knowledge into social capital (Herz, 2001): not only do players 'own' their knowledge (because they have participated in the construction), but they admit ownership in a social context where one's status derives from peer acknowledgement, which can be an incentive more powerful than some traditional teacher evaluation and traditional peer-assessment. Finally, collaborative games can provide students with a framework of rules and roles through which they can learn interactively through experience and be more engaged in the learning activity (Usart, Romero and Almirall, 2011). Following Ash (2010), a game-based environment allows to simulate both literacy and skills, because students can experiment different outcomes, and they can, through trial and error, begin to develop those skills.

Although the cited advantages of GBL as an active and engaging learning methodology, it deserves further study, in particular, for trivia or classification games. In this type of games, simple trial and error game mechanics could lead students to an acceptable performance, but a poor knowledge acquisition; Young (2009) shows that this type of games, when no cues on the other players or consequences of own performance are given, can lack of learning outcomes. Furthermore, tailored learning activities and contexts can lack of enough information for individual actors involved regarding exactly what to do, and thus making the learning situation, both individual and collaborative, harder (Nelson, 2008). In order to study how to overcome these difficulties, we propose a case study on MetaVals Serious Game (SG) that can help players in the reflection of their performance during the game. This exploratory study is a further implementation of the 2012 virtual-peer release of MetaVals in Carol I University, and is focused on quantitative aspects of the gameplay and implements real dyads.

2. Military use of GBL, a little history

The use of games for training purposes within the military is mostly tied to the year 2002 when the Serious Games Initiative first came into being, as a counter-argument to Huizinga's (1938) "to our way of thinking, play is the direct opposite of seriousness". Fighting lots of criticism, it has been proven that within this –as such defined –second world" reason and normal rules of life are suspended, in order to experience intensively, to live and decide upon things that would otherwise be too costly to experience for the sake of training itself. Simultaneously, the term Immersive Learning Simulation has gained contour, as a "corporate friendly synonym for serious games" (eLearning Guild, 2008) where games' elements and pedagogy boost students' motivation by, and immerse them into the purpose and goals of a learning interaction" Should we mention the incipient stages, *America's Army*, developed for the U.S. army and distributed free starting with 2002, is considered the first serious game that counts. Statistics say that there were over 17 million downloads in 2004 only. Also used by the military in Europe, GBL (Serious Games and simulations) proves its value in recruits' training, being used for medical training, training on complex equipment and battle simulation or personnel rehabilitation. Moreover, to highlight the importance and effectiveness, the US department of defense launched a US$ 50 million for a 5 year programme of game development focused on recruit training in 2010. Serious Games and immersive learning simulations have proven effective and efficient in military training for more than ten years now, as they offer the potential to improve learning performances. Games motivate, they are learner-centred, they offer an 'active learning' experience (Bonwell and Eison, 1991). This approach can increase learner control and the ability to explore materials morer guidedly, which has been shown to improve learning performance to a certain extent (Makany, Redhead and Dror, 2007). Moreover, when avatars or virtual coaches are involved and interact with intelligent characters, this can enhance a strong feeling of 'presence' within the player (Heeter, 1992) Training in military world means training adults which, in its turn calls for the andragogical features of the teaching process: real-world problems, projects and realistic contexts need to be exposed to the adult learner to enhance his motivation and for the knowledge transfer to be performed (Herrington and Oliver, 2000) The learning experiences offered by games and simulations, by game –based-training generally, are all in line with the way adults see learning for themselves- as self-regulated learners, adults want to decide when to stop and when to begin, what to learn and what they need to take from the learning experience, based on their own, specific learning needs, to be applicable on a long term but with an immediate application, quite after the learning process ends.

Also, the low training costs, the reduced training time, the proven increased learner engagement and motivation along with the improved learning outcomes, all give strong reasons to hold game-based learning as the incresingly preferred means of knowldge and skill transfer when it comes to adult learners performing in military environments, where time is important and where technology is an ally, not an aquaintance or an enemy.

3. The Level of Certainty as a mechanism to avoid the trial and error

SGs should provide students with tools that help them reflect on their cognitive process during the gameplay, and thus minimize the previously outlined disadvantages of trial and error. The Level of Certainty (LC), is also known as Level of Confidence (Roebers, 2002; Schraw, 2009) and is commonly defined as the metacognitive judgement of a learner when self-evaluating how certain he or she is about the accuracy of an answer to an item. LC in answering or classifying an item has been widely studied, but not in computer-based GBL. In the present study, we focus both on three stages: individual LC elicitation, LC sharing with a virtual peer (2012 experience) and with a real partner (2013 experience), and finally the individual LC elicitated after the discussion stage of the GBL activity.

Previous research relates LC elicitation to higher performance in individual learning activities. According to some authors (Kirschner and Erkens, 2006) this could be due to the fact that individual students reflecting on their own cognitive process are more aware of what they previously know, and thus are able to reach deeper learning results. In a test-based task, Valdez (2013) studied the relation between LC and performance and uses the concept of overconfident (OC), accurate (AC) and underconfident (UC) students. He shows that students' confidence estimates can influence their ability to accurately control and adjust their responses to test items. In particular, Valdez affirms that OC students (individuals showing low performance and high LC) may more easily be drawn to multiple-choice selections that are near approximations of the correct answer. On the other hand, UC students (that is, students with a high performance but low LC) could spend unnecessary time on a few test items and thereby limit their opportunity to execute test-taking strategies. Furthermore, Liberman (2004), based May (1988), states that individuals' average confidence across questions (LC) exceeds the average performance; that is students tend to exhibit OC in this kind of judgments.

In collaborative learning contexts, tools helping information sharing among peers, in particular performance and LC cues, could help mutual performance monitoring for learning teams to become effective. However, interpersonal trust is also conditional for building adequate shared mental models (Fransen, Kirschner and Erkens, 2011). Also Karpicke, Butler and Roediger (2009), and Swanson (1990) show that students' consciousness of their LC cannot be assumed during any individual learning process, neither the elicitation of the LC in collaborative learning situations when learners must solve a problem collaboratively. In order to help students in this process, we propose the implementation of a LC tool, a 10-grade Likert scale for each item of the GBL task presented, and study its impact on students' performance and confidence, both for virtual and real dyads, as will be further detailed in the methodology section.

4. Methodology

This case study started in 2012, when MetaVals SG was implemented in a course among military students in Carol I University (Popescu, Romero and Usart, 2013). In this first experience, 5 adult students (*M*=44.4; *SD*= 1.82; one woman, 4 men) played in dyads with a virtual peer in order to correctly classify 12 items into assets and liabilities. In 2013, 6 students (*M*= 42.8; *SD*=1.30; one woman, 5 men) have also played the same MetaVals SG, but with real partners, as the game allows personalization and adapts to different learning contexts. In particular, virtual peers for the 2012 gameplay were set in two levels: expert (LC=10 and performance=10), and non-expert (LC=0, performance=0). The two contexts of study implemented a pre-test on financial literacy, the MetaVals game, and a post-test about the experience. Overall, experience lasted 40 minutes. Compared to the 2012 experience, the present 2013 study case allowed us to highlight the importance of collaboration in real environments among the team-players- even though their language level was weaker than in the group last year- and the strong case real opponents make in boosting motivation and immersion, as compared to virtual players, which we competed against in 2012. Also, the confidence in the gaming experience itself both in terms of knowledge and skill transfer is better this year, due to the real competition, compared to real-virtual dyads last year.

Exploratory measures focus on students' prior knowledge (PK) measured in the pretest, self-reported level of knowledge and experience (PE) in financial terms, game performance in the three phases or stages of MetaVals (individual, correction and discussion), students' LC for each phase, as measured from the 10-grade scale attached to each item, and last but not least; the accuracy for each student in each phase, as OC when items' LC was higher than performance, AC for LC equal to performance, and UC for students with low LC and high performance.

5. Results

Results from the Pretest and MetaVals SG for both PK and performance are detailed in table 1. Learners in both samples rate their own PK and PE as high, in average. Nevertheless, students have a very high prior knowledge according to the pre-questionnaire: they all have 0 mistakes in the 3 questions on assets and liabilities.

Context	**2012 Context with virtual dyads**						**2013 Context with real dyads**					
Phase	Individual		Correction		Discussion		Individual		Correction		Discussion	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Pretest PK	10	0					10	0				
Self-reported PK	5.80	2.95					7.67	0.52				
Self-reported PE	5.60	1.34					7.67	0.82				
Performance	7.33	0.91	7.66	3.25	7.67	1.49	6.94	1.95	7.50	1.75	8.06	1.39
LC (/60)	47.40	5.94	51.40	13.56	45.80	7.60	58.17	2.56	58.83	1.32	58.00	2.79

Table 1. Pretest and MetaVals average results for 2012 and 2013 samples in a 10-grade scale

Concerning MetaVals performance and LC, a higher performance is observed for discussion phase compared to individual and correction stages, both for 2012 and 2013 samples, as represented in figure 1 (performance) and figure 2 (LC). Furthermore, 2013 students have a higher performance in average for the discussion phase, but lower for individual and correction. LC scorings are higher in average for 2013 students, and are similar for the three phases of the game, as can be observed in figure 2.

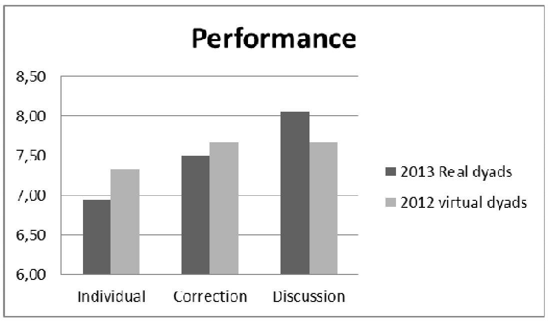

Figure 1. Students' performance for the three phases of the game, in the two experiences

Finally, students' accuracy was studied for each player, during the evolution of the gameplay; that is, for the three phases of the game. In Figure 3, the five different patterns found in the sample are listed. We can see that students in 2013 are more overconfident than those from 2012. In particular, OC and

AC students with peers in the same accuracy remain equal during all the gameplay; on the other hand, dyad with an OC and AC student tend to change their roles in correction phase, and come back to their previous roles when discussion takes part.

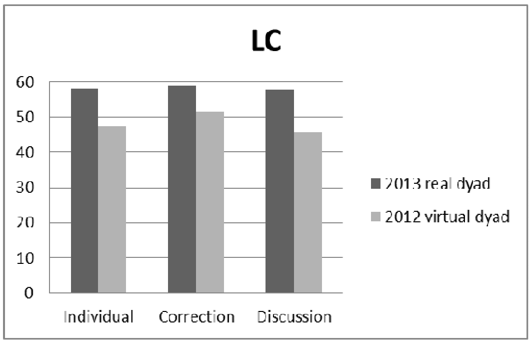

Figure 2. Students' LC for the three phases of the game, in the two experiences

Overconfident

Ind.	Corr.	Disc.	Players with this pattern in 2012	Players with this pattern in 2013
OC	OC	OC	-	2 players (same dyad)
OC	AC	OC	-	1 player
AC	OC	AC	1 player	1 player
AC	AC	AC	2 players	2 players (same dyad)
UC	AC	UC	2 players	-

Underconfident

Figure 3. Students' accuracy pattern for individual, correction and discussion phases

Post-test results show that the skills practiced in the game will be probably useful in less than 3 months or 1 year (3.9/7). Students think it was easy to become skilful with the game, and that the interaction with the game was clear and understandable (5.9/7). Players rate their ICT competence as medium-high in average (5/7), and they prefer playing MetaVals SG in an online environment rather than as a paper-based activity (4.8/7). Finally, students found the experience positive in general (5.3/7) and they would play again (5.2/7), although the game level was not rated as very easy (4.2/7).

6. Discussion and conclusions

Pretest results can be useful for understanding military students' accuracy when elicitating their PK. In our study, both for 2012 and 2013 samples, participants self-rate their PK lower than their real knowledge level measured in the knowledge pretest. In particular, 2012 students are less accurate in this judgment than their partners from the 2013 course. This could be due to the fact that adult students are conservative by nature (Cranton, 2000; Knowles,1984), and they are much so when they are military, at least when they do not know the activity they will have to perform (in our case, the items they have to classify). We could affirm that these students do not want to seem overconfident before playing. Nevertheless, from the MetaVals performance and LC results, we observe that students during the gameplay tend to be more self-confident than in the previous questions. In particular, students in 2012, playing with virtual dyad-mates, show higher performance in individual phase and correction phases of the game, when compared to real dyad results (2013 group). Looking at the discussion phase, as predicted by the CSCL and collaborative GBL theory, real dyads reach a higher performance than students with a virtual peer, due to the fact that dialogue and knowledge debate leads to better learning result through shared knowledge construction (Herz, 2001). Furthermore, as Fransen, Kirschner and Erkens (2011) show, real peers' interpersonal trust is conditional for building adequate shared mental models; and this happens in the 2013 context, with a higher discussion performance than 2012 experience.

Military adults are in a competitive ambient, they are especially trained for competition and not allowed to show weakness in work situations, as they" at the fore-front of an ever-increasing array of challenges" (Nagl and Burton ,2010). In the two samples of our study, participants tend to be overconfident and accurate rather than underconfident. In particular, the fact that students are UC when they rate their PK, but OC in their item-by-item performance judgment is in accord with previous studies: Liebman (2004), who differentiates among overall LC and item-LC, states that students tend to be UC for the first, while they are OC for latter, as seen in figure 3. Furthermore, the same author, based on May's (1988) results, Affirms that individuals' average confidence across questions (corresponding to our measure of LC) exceeds the average performance. We meet these results, as our sample also has a tendency to exhibit overconfidence in these judgments during the MetaVals SG.

Also concerning accuracy along the gameplay, we observe some interesting differences between the 2012 context with virtual players and the present context with real peers. Players who are initially AC, OC or UC seem to be influenced by their partners (virtual or real) in the correction phase, where they increase performance if their peer is expert, and decrease if their partner is non-expert. Nevertheless, in the 2013 context, dyads with peers in the same accuracy initial level remain the same during the collaborative phases. Finally, in both experiences students changing their accuracy in the correction phase come back to their previous LC in the discussion phase. That is, students finally stick to their own initial viewpoints, even if they change it for a while during the second phase. This could be due to the fact that having access to peers' metacognitive judgments could influence own judgments during a particular task, but not in a permanent manner (Kirschner and Erkens, 2006).

Finally, as pointed in our previous study, participants' thoughts about MetaVals are also useful for SG development. In Popescu, Romero and Usart (2013) we detail the 2012 sample beliefs on MetaVals. They go in accord with the 2013 group ideas: the game was easy to understand, playful and clear for students in both samples, nevertheless, they do not specially expect to play it again, and they think it will not be useful in their work. Students could find the game motivating as they rated it as not easy and they prefer web-based gameplay.

Next steps, both in design and implementation of MetaVals will go on this direction, allowing students to play online, with the implementation of interactive help and information within the game. In this direction, future studies with MetaVals should face the present challenges and focus on Overconfidence due to the psychological profile of military adult students, but also accurate. Performance is higher for collaborative, LC stays constant. In particular, we look for greater samples, including non military students. We believe that the present study could be useful to help understanding the implementation of LC tools to help performance and self-reflection on the learning process for collaborative GBL.

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Learning toolkit in the Digital Agenda

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Abstract

As a natural ability, learning skill is a continuous ongoing process itself, with different results and consequences depending on each human activity.

By declaring the Society of knowledge and Lifelong learning support, the directives and measures revealed and encouraged many actions to increase the use of digital technologies in learning process, as an effective way to extending the dynamics of this process and also as an extension for the entire cycle of life.

National and European regulations have raised awareness of the need to build a set of digital tools for learning as well as procedures and practices based on the specific activity, category, nature of job, age categories and the scope of learning. To make a conscious process of learning throughout life and to get maximum results, it is necessary and useful to obtain an inventory of main categories of the digital tools for learning, considering Digital Agenda for Europe and concerns at national level in the field.

Keywords: Learning process, Digital Agenda for Europe, Online tools

Introduction

According with Industrial Policy Communication Update COM (EC 2012), European education and training systems continue to fall short in providing the right skills for employability, and are not working adequately with business or employers to bring the learning experience closer to the reality of the working environment. There remains significant evidence of underperformance in other areas: 73 million adults have only a low level of education; nearly 20% of 15 year olds lack sufficient skills in reading; and participation in lifelong learning is only 8.9%. By 2020, 20% more jobs will require higher level skills. Education needs to drive up both standards and levels of achievement to match this demand, as well as encourage the transversal skills needed to ensure young people are able to be entrepreneurial and adapt to the increasingly inevitable changes in the labour market during their career. The European Commission identified a limited number of strategic priorities to be addressed by Member States, alongside new EU actions to leverage national efforts (EC 2013a). 2013 European Commission's recommendations for Romania in brief, in the areas of Education reform (EC 2013b) reflect the priorities for education and innovation: “Romania faces a major challenge in raising the quality of its education and training system. Early school leaving is a significant challenge. Romania should implement its reforms whilst building up its administrative capacity. Tertiary education should be aligned with the needs of the labour market and improve access for disadvantaged people.”

Considering Europe Horizon 2020 in Romania and the Country Specific Recommendations (CSRs) we have to identify all the additional ways that can help the improvement of educational process, not only the school but also the related tools that could be used for accomplishment of those CSRs, in the process of formal and informal learning too, for a large category of participants.

First, we discuss the needs for each category and the possibilities that new advanced technologies offers, in a variety of digital tools and methods. The goal exprimed by Neelie Kroes, Vice-President of the European Commission responsible for the Digital Agenda is to get Every European Digital (Kroes N., 2013), is clear that has to include education and training. That means every teacher digital and every student digital, right from the very start of formal education, and as part of lifelong learning.

We consider that together with the traditional school the digital tools for learning represent a really toolkit for educational reform improvement, helping learning and innovation. We can include here also the tools for learning available on CORDIS (Community Research and Development Information Service), the data base with European Research projects, (EC 2013c), online dictionary (EC 2013d) or the elearningeuropa.info portal at http://www. elearningeuropa.info/ .

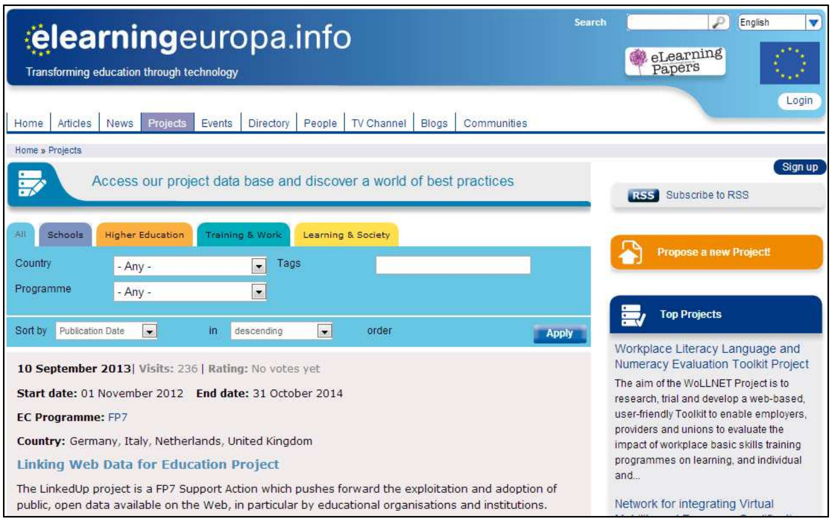

Figure 1. Tools for Learning on elearningeuropa.info

Technology helps us learn

Information and communications technology has already transformed how we connect, interact and transact. With the right tools and the right approach, we can also give learning and education their rightful place in this process. “The Internet, smart-phones and tablets are a world of opportunity. They are as readily available, as readily usable for today's generation as the home telephone, radio and the television once were” (Kroes N., 2011).

Basic education in primary schools

Learning tools for specific basic education in primary schools must give the solutions to transform the relationship with knowledge - how to find it, access it or acquire it. The new technologies give the possibility to make an opportunity for everyone and for each of us from the earliest age, including at school, not only when we are locking onto a career path (Stoica M. et all, 2013). For formal education in schools and for informal education throughout our lives, putting learners and learning at the centre of the efforts we have to consider three key steps:

1. Making digital literacy, digital skills and technology supported learning a main goal. ICT specialists and teacher design teams can work together for integrate information skills in the curriculum of the school.

2. Using the full range of funding and support, because the EU invests heavily in this area, around 60 million euros in research and innovation every year; Horizon 2020 research programme will carry on that good work for the next decade.

3. Engaging all stakeholders and tacking care about cultural inertia, getting everyone together, in a common, multi-stakeholder platform.

For Romania, the correct order of the digitization for educational process involves three steps (Alex R., 2013):

1. Connection of all schools to the Internet;
2. Development of the program "educational software" and digital textbooks;
3. Ensure proper training for teachers, "before entering the classroom" and investment in equipment following these steps.

Academic learning environment

Technology and the expectations of students are also changing. The main question for this category of participants is “What tools can give students the best opportunities to improve themselves?”

Students increasingly expect to choose what they learn, how they learn and when they learn, according to their individual needs and interests. They are ready to do it in their country of origin, abroad, via courses offered online or via blended forms of learning combining all of these possibilities (EC 2013).

Digital education, and in particular the emergence of massive open online courses (MOOCs) is also bringing new incentives for strategic partnerships between education institutions, and new opportunities to reach potential students who may not be able to travel or take a break from employment but who are eager to profit from higher education offers outside their country. New technological solutions can vastly improve learning systems like never before.

They use tools that are not just theoretical ideas, not just for the rich or the lucky: these technologies are routinely and readily available. The big number and the diversity of online free digital tools for documentation or learning, as online courses, tutorials, dictionary but also new methods for create content, presentation, videos, graphs, graphics, maps or tools for building digital manuals are concluding examples.

Category of digital tools for learning

What constitutes a “learning tool”? This could be a tool you use to create or deliver learning content/solutions for others, or a tool you use for your own personal learning.

Technology can tailor learning, it can help people learn in their own way, wherever they are, and throughout their lives, because no two people learn alike.

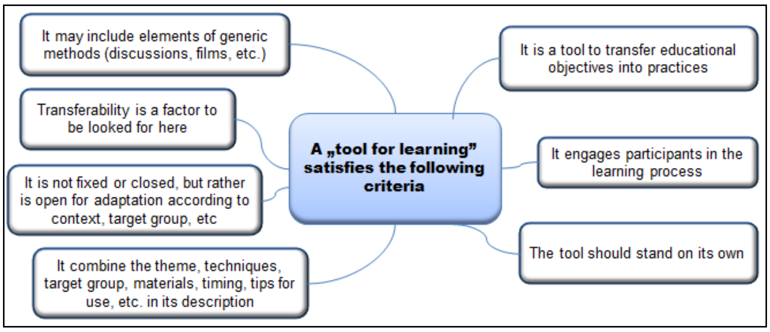

Figure 2. The criteria of the tools for learning

With what specific tools, on every category, can we do that? Ensure that, in every classroom, in every workplace, in every home, everyone can learn in the way that best suits them? https://edshelf.com/profile/skprice/great-free-tools-for-teachers .

There are as many ways to learn as there are learners. Some people need time to approach an idea from new angles; some people want to hear an explanation, others to see a demonstration; some learn best by themselves, others in a group; some in a formal learning environment; others at home. That is the reason why we need to know all the new digitally tools that help us learning in our specific efficient way and to give for the children the best chance in life.

We need to combine all those digitally tools and let technology support and enhance learning. The Top 100 Tools for Learning 2012 is the results of the 6th Annual Learning Tools Survey, as voted for by 582 learning professionals worldwide and compiled by the Centre for Learning & Performance Technologies. A summary can be found at: http://c4lpt.co.uk/top100tools/ . I grouped these tools on their functionalities:

- **Office Tools**
  - Presentation tools:
    - *PowerPoint* - Presentation software
    - *Keynote* - presentation software
    - *Prezi* - Presentation software
    - S*lideshare*- Presentation hosting site
  - Document tools
    - *Glogster EDU* - Interactive poster tool

- **Blogging & Wiki Tools**
  - Blogging tools:
    - *Edublogs* - Educational blogging platform
    - *Blogger/Blogspot* - Blogging tool
    - *WordPress* - Blogging/website tool
    - Kidblog – blogs for teachers and students
    - Tumblr - micro-blogging tool
  - Wiki tools:
    - *Wikipedia* - Collaborative encyclopaedia
    - *Wikispaces* - Wiki hosting platform
- **Video, Audio & Image Tools**
  - Photo tools
    - *Adobe Photoshop* - Photo editing software
    - Picnik - photo editing tool
  - Audio tools
    - *Audacity* - Audio recorder/editing tool
    - AudioBoo - mobile/web platform to record and share audio
  - Video hosting tools
    - *YouTube* - Video-sharing site
    - *TED Talks/Ed* - Inspirational tools/lessons
    - *Google Art Project* – explore 17 museums from around the world
  - Movie making tools
    - *Animoto* - Video creation software
    - MovieMaker - make home movies

- Screen capture and screen casting tools
  - Camstudio – screen-recording software
  - *Camtasia* - Screencasting tool
  - *Jing* - Screencasting tool

Networking & Collaboration Tools

- Public social networks
  - *LinkedIn* - Professional social network
  - *Facebook*- Social network
  - *Twitter* - Social network & micro-blogging service
  - *SharePoint* - Collaboration platform
  - Elgg - social networking engine
  - Flipboard – your (pocket-sized) social magazine for iPhone/iPad
- Educational and enterprise private social networking platforms
  - *Edmodo* - Educational social learning network platform

Live Communication Tools

- Instant message tools:
  - *Skype* - Text and voice chat tool
- Webinar and web meeting tools:
  - *Adobe Connect* - Web conferencing software
  - GoToMeeting - web conferencing tool
  - MindJet - real time collaboration and sharing

Productivity Tools

- Search and research tools
  - *Google Sites* - Web/wiki hosting platform
  - Wolfram Alpha – computational knowledge engine
  - *Google Books* - Search and preview millions of books from libraries and publishers worldwide
  - *Google Scholar* – scholarly search
  - *Google Translate* – online language translator
  - SchoolTube – video sharing for students and teachers
  - *Google Maps* - Interactive maps
- Note-taking tools
  - *Evernote* - Note-taking tool
  - *Diigo* - Social bookmarking/ annotation tool
- Mind mapping tools
  - *Mindmeister* - Mindmapping software
  - Freemind - mindmapping tool
  - *Mindomo* - mindmapping and brainstorming tool
  - *Doodle* - easy scheduling
- Technical communication: SolidWorks Student Access Initiative

Readers & Dashboards

- Media management tools
  - *Instapaper* - save web pages to read later
- Readers
  - *Kindle* - eBbook reader

Instructional & Educational Tools

- Learning and e-portfolio platforms
  - *Moodle* - Course management system

    - *Blackboard* Course management system
- 3D design and engineering analysis: SolidWorks Education Edition
    - *Google SketchUp* – 3D modeling for everyone
- Online courses: Coursera,
- Other educational tools: Course Builder, provided by Google
    - Lectora - course authoring tool

- **Mobile and Cloud storage tools**
    - Android phones and tablets Devices using Google mobile operating system
    - *Google Docs/Drive* - Office suite and data storage service
    - *Dropbox* - File synchronization
    - *Windows Skydrive* - File synchronization

Applying technological tools of real-time data and assessments, adaptive software, online and digital content from many sources and constant communication with students and others involved in a student's education process, the teacher is able to design the pathway that works best for each student to realize his or her maximum learning potential.

In a digital learning environment, there are three important overlapping elements: (1) teachers are transitioning to education designers to personalize learning for all students; (2) time is used differently in the classroom and beyond; and (3) technology includes digital learning tools, resources, and practices.

Blogging in education and training can be useful in a similar way to the use of blogging for professional development; students can be encouraged to start a learning log, or even a learning portfolio. Even though these are usually used as a means of assessment on a course or programme, they can begin the process for continuous life-long learning.

Wikis for Students. Teachers use wikis for students to post work and collaborate. The teacher can post a question or reflection for the students to comment on.

YouTube.com/Teachers was created to help teachers use educational YouTube VideoContent to educate, engage and inspire the students.

Google Docs is an easy-to-use online Text Editors, spreadsheet and presentation editor that enables to create, store and share instantly and securely, and collaborate online in real time. All the work is stored safely online and can be accessed from any computer; it can create new documents from scratch or upload existing documents, spreadsheets and presentations.

Animoto. This site allows students to create videos. The students upload photos and music, or they can choose some from the site. It also has the option to add your own video clips.

Glogster. An online animated poster. Students can be creative by upload music, pictures, and videos along with adding graphics and text. Students can even add links to the pictures and videos.

Prezi is cloud-based presentation software that opens up a new world between whiteboards and slides. The zoomable canvas makes it fun to explore ideas and the connections between them. The result: visually captivating presentations that lead your audience down a path of discovery.

Wolfram Alpha is a computational knowledge engine. Its purpose is to be a serious knowledge engine, which computes answers to questions.

Conlusions

Innovation and knowledge are the lifeblood of the economy, essential for a prosperous life. Innovation and knowledge can give the boost to get out of the crisis. Using technology properly, it can create both the smart jobs for the next generation and the educated workforce that can fill them.

Learning new things is not just for pupils and trainees: it is for everybody in the education and training system. Teachers, too, can learn to do things differently and to capture the massive opportunities of the digital future.

This paper presented toolkits to provide digital learning resources and ideas for teachers in specific subject areas. The tools and resources in these toolkits are not the totality of good information available; instead, they are designed to provide guidance on how technology and digital learning can enhance the educational experience and outcomes for all students.
We continue to add to this collection and welcome any ideas, tools, models, or resources to create a system where teachers have the technological tools to reach out to students of all needs, backgrounds, and abilities, to stimulate an economy that produces wild, exciting innovations to support the education sector and to build a society where education is the main support for progress.

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Model for Calculating the Rank of a Web Page

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Abstract

In the context of using the information from the Internet in all areas of activity, the mechanism of finding web pages that contain information about a particular subject has a very important role. In this article we present a way of ranking web pages in a web application that can be used by various algorithms in a search engine. Ranking web pages will be made calculating the rank of a web page according to certain design features.

Key words: Page Rank, HITS, Search Engine, Web Application, HTML, XML

Introduction

The increasingly bigger quantity of information we have access to from the Internet creates difficulties in the search of precise information. Word Wide Web database is characterized by three fundamental things: content, structure and links that exist between documents.

The documents content is diverse, but the most common are the texts.

The document structure can be organized as a tree using HTML and XML tags; efforts in this area have focused on automatic extraction of DOM structures (document object model) from documents.

The links allow connections between documents, on the same location or from different locations.

All the documents from WWW are viewed using web pages. All web pages form a chaotic structure, from which information can be extracted with difficulty; this operation is simplified by search engines. They use various algorithms to provide users with lists of web pages with related information. Among these algorithms, two have proven time benefits; these are the PageRank and HITS.

Models of software used to search information based on queries are presented in [6.6], [6.7] and [6.2].

PageRank algorithm, also used by Google's search engine, calculates the importance of web pages by taking into account not only the number of pages that have a link to it, but also the importance of the pages that access it.

HITS algorithm, also used by Clever search engine, take into account the notion of authority, namely the major websites in terms of content and the hubs, which are pages that serve as indexes (lists of resources that directs users to the authorities).

A comparing study of these two algorithms has been made in [6.3], [6.9], [6.6].

This article's purpose is to offer a list of web pages from a web application, ordered by their importance, which can be used in the process of searching information using queries by the search engine's algorithms. The importance in the application is given by the web page's rank for the search operation, which will be defined taking into account its content and its accessing from the outside or the inside of the application.

The constructive characteristics taken into account when determining a web page's rank

In the operation of searching information using a search engine, words are the most often used. Some of them have a special meaning: names of images, URL addresses, names of web pages, etc.

In order to simplify the search methods, some algorithms use certain values for the web pages which are named web page's rank. This value can be calculated in different ways, many articles approaching this subject. The method a web page's rank we will present is first of all related to the web application that contains the page and, second of all, to the number of links which access the page from the inside of the application. This way, we propose to the search engines to perform searches on web applications which have their web pages sorted descending after the value of their rank.

Next, we will consider a web application WA composed from the web pages $P = \{p_1, p_2,\ldots, p_n\}$.

When calculating the rank of a web page from P in relation with WA, we will use the next categories of words:

C_1 – words from the web page's title
C_2 – words from the content of the web page, written with bold
C_3 – words from the content of the web page, written with italic
C_4 – words from the content of the web page, written underlined
C_5 – character sequences which represent a URL address
C_6 – character sequences which represent names of files
C_7 – words used in tables

When searching information, the importance of the web page is also very relevant, for example the number of web pages which access it through links. A method of calculating the rank of a web page from this point of view is presented in [6.10].

Words from every category have a certain weight in calculating the rank of a page. Those weights will be noted with $v_1, v_2, ..., v_7$.

Definition 1

Let p_i be a web page from P. By noting with t_j the number of words from WA which are from the C_j category, with j from the set {1, 2, ...,7}, the rank of the p_i page is the next one:

$$Rank_{WA}(p_i) = (a_{i1}\cdot v_1+a_{i2}\cdot v_2+...+a_{i7}\cdot v_7) / (t_1\cdot v_1+t_2\cdot v_2+...+t_7\cdot v_7)$$

where a_{ij} represents the number of words from p_i which are from the C_j category, with j from the set {1, 2, ...,7}.

Remark 1

For any j from the set {1, 2, ...,7} we have $a_{1j} + a_{2j} + ...+ a_{nj} = t_j$.

Definition 2

Let p_i be a web page from P. By noting with b_i the number of links from WA's pages which access p_i, the navigation rank of the page p_i related to WA is the next one:

$$RankNav_{WA}(p_i) = (1+b_i) /(1+L),$$

where L is the number of links from all the pages from WA.

Remark 2

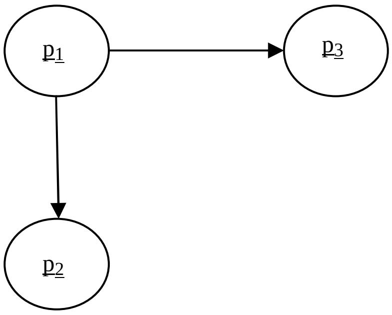
If WA has n=1 and p_1 does not contain links to itself, than $RankNav_{WA}(p_i) = Rank_{WA}(p_i) / (1+L)$.

Definition 3
Let p_i be a web page from P. We define the rank of p_i web page as being the number:

$Rank(p_i) = Rank_{WA}(p_i) \cdot RankNav_{WA}(p_i)$.

Case study

We will next consider a web application WA which contains 3 web pages P = $\{p_1, p_2, p_3\}$, composed of HTML tags. The navigation tree in WA (as it is defined in [6.4] and [6.5]) is the next one:



The web pages together with their source code are the next ones:

Name html file	Web page source	Web page
p1.html	<HTML> <HEAD> <TITLE>Butterfly Page</TITLE> </HEAD> <BODY BGCOLOR=silver> <B>Filfizon</B> butterfly <IMG SRC="butterfly.jpeg"> <I>flying</I> from <B>flower</B> to <U>flower</U> My friend Information </BODY> </HTML>	
p2.html	<HTML> <HEAD> <TITLE>Butterfly Page</TITLE> </HEAD> <BODY BGCOLOR=silver> Red butterfly <IMG SRC="RedButterfly.jpg"> flying from flower to <U>flower</U> </BODY> </HTML>	

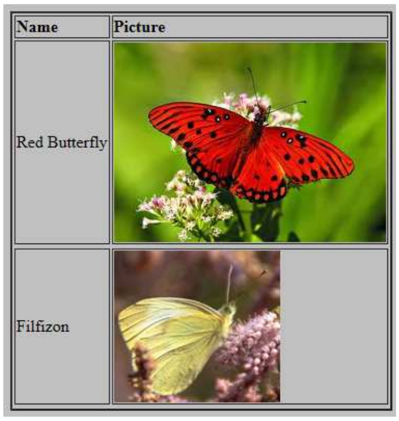
p3.html	<HTML> <HEAD> <TITLE>Info Page</TITLE> </HEAD> <BODY BGCOLOR=silver> <TABLE border="2"> <TR> <TD><B> Name </B> </TD> <TD><B> Picture </B> </TD> </TR> <TR> <TD>Red Butterfly</TD> <TD><IMG SRC="RedButterfly.jpg"></TD> <TD> <TR> <TD>Filfizon</TD> <TD><IMG SRC="butterfly.jpeg"></TD> <TR> </TABLE> </BODY> </HTML>	

Table 1

To calculate the rank of each web page from the web application we will use the same weight, more exactly v1=v2=...=V7=1.

By analysing the source code of the three web pages we obtain:

t_1=2+2+2=6 (the number of words from the title of WA web pages);

t_2=2+0+2=4 (the number of words from the content of WA web pages, written with bold);

t_3=1+0+0=1 (the number of words from the content of WA web pages, written with italic);

t_4=1+1+0=2 (the number of words from the content of WA web pages, written underlined);

t_5=2+0+0=2 (the number of character sequences which represent a URL address in the web pages of WA);

t_6=3+1+2=6 (the number of files name from the source code of the web pages from WA);

t_7=0+0+5=5 (the number of words used in the tables of WA web pages).

Thus, we obtain:

$$t_1 \cdot v_1 + t_2 \cdot v_2 + \ldots + t_7 \cdot v_7 = 6+4+1+2+2+2+5=22.$$

By using the source code of the web pages in Table 1, we obtain the data in Table 2.

Name html file	**$Rank_{WA}$**	**$RankNav_{WA}$**	**Rank**
p1.html	(2+2+1+1+2+3+0)/22 =11/22=1/2=0.5	(1+2) /(1+2)=1	0.5
p2.html	(2+0+0+1+0+1+0)/22 =4/22=2/11=0.1818	(1+0) /(1+2)=1/3 =0.3333	0.06059
p3.html	(2+2+0+0+0+2+5)/22 =1/2=0.5	(1+0) /(1+2)=1/3 =0.3333	0.16665

Table 2

According to the data in Table 2, the descending order of the ranks gives us the hierarchy: p1, p3, p2 which can be used by the search engine algorithms.

Algorithm for determining the list of the web pages from a web application depending on rank

According to those presented in Section 3 we have the following algorithm:

Input data

- Path (address) where the web application is, in a string s.
- The weights $v_1, v_2, ..., v_7$.

Output data

The list of the addresses (including the name) of the web pages in descending order of the rank.

Step 1. Initialization of all the variables used in Section 3 with the number 0.

Step 2. Navigation tree of pages in WA is searched (in width or depth), starting from the root located in the page from the address in s and for any current web page (with the order number i, located at Adr_i) the source code is read and the next variables are updated:

- $t_1, t_2, ..., t_7$
- $b_i, a_{i1}, a_{i2}, ..., a_{i7}$ (there is no need to use a two-dimensional array of 8 columns, we can use a one-dimensional array with 8 components, as the values should not be withheld from a web page to another)
- L

Step 3. Using the values from step 2, there are calculated:

- $Sum=t_1 \cdot v_1+t_2 \cdot v_2+...+t_7 \cdot v_7$
- $Rank_i$

Step 4. After calculating the rank for all the web pages in WA, we get the pairs: ($Rank_i$, Adr_i), i from {1, 2, ...,n}.

Step 5. The pairs ($Rank_1$, Adr_1), ($Rank_2$, Adr_2),..., ($Rank_2$, Adr_2) are ordered descending after Rank.

Conclusions and future work

We want to implement it in Java the model presented in the previous sections in order to obtain an efficient application for determining the list of the web pages from a web application given by its address. Then we want to accomplish a detailed study to identify the most appropriate values for the input data which should be used by the algorithm from Section 4, while we look for new factors to be taken into account in determining the rank of a website, including external web applications, such as those presented in [6.8] and [6.11].

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The BLEU Algorithm Utilization for the Students Knowledge Evaluation Under an Intelligent Tutoring System

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Abstract

The Intelligent Tutoring Systems have captured the attention of the researchers since the beginnings of the computer programming domain study, these systems being capable to combine three different primary domains which are: the Artificial Intelligence, Cognitive Psychology and Education (Woolf, 2009). Currently, it is believed that Intelligent Tutoring Systems will represent the future of education and will take gradually the place of the traditional educational system although the Intelligent Tutoring Systems efficiency is still debated. The specialized studies have demonstrated that a student who is using a well-developed instructional system is able to achieve one class above the average of a public school class, mainly due to the fact that an Intelligent Tutoring Systems has the capability to adapt to the student's knowledge and abilities.

In this paper it is presented the BLEU algorithm and the manner how this algorithm it is used to evaluate the answers formulated as text and provided by the students to the questions generated by an Intelligent Tutoring Systems. The Intelligent Tutoring System proposed by the author of this article has the capability to assist the students and any other users who are looking to acquire knowledge related to the computer programming discipline.

Keywords: BLEU algorithm, students knowledge evaluation, Intelligent Tutoring System, tutoring model, Machine Translation

Introduction

In the actual context in which the activities from all domains are in a very close interdependence with the instructional process, the courses can't take place anymore only in the old school fashion, in the classrooms only, but have to move to a new phase, a phase which involves the use of computers within the entire instructional cycle (teaching-learning-assessment-feedback). This new phase of the instructional process evolution has been named in several ways but within the paper scope the author of this article will call it as the computer-assisted instruction era.

One of the study areas which has captured the attention of the researchers, since late 1960's, is the Intelligent Tutoring Systems (ITS) domain. According to researchers (Nwana, 1990; Woolf, 2009), the ITSs have been developed from linear programs developed at the beginning of 1950's.

After several transformations occurred during the evolution made possible based on the ICTs and Artificial Intelligence developments, the researchers succeeded in early 1980's to develop the first ITS (Nwana, 1990). Since then the ITS has became one of main tools used by students and teachers to achieve a better performance and superior knowledge.

BLEU Algorithm

Machine Translation Systems

The *Machine Translation* (MT) is a domain of the computational linguistic which, according to Payson et al "[…] investigates the use of computer software to perform text translation from one natural language (the source language) to another (the target language)" (Payson et al, 2010). Callison-Burch et al consider, on one hand, that the evaluation by a human expert of the MT systems requires an extended period of time, lot of efforts and is too expensive and on the other hand, the task itself sometimes became to be impossible to be accomplished by such expert (Callison-Burch et al, 2006). Therefore, was necessary to have a *specialised tool* to perform such evaluation.

Due to such necessity, Papineni et al, specialists from IBM, have developed the *BLEU algorithm* as the engine for evaluating the MT systems (Papineni et al, 2002). According to Callison-Burch et al, in the year 2006 BLEU algorithm was considered the most used algorithm for the MT systems evaluation (Callison-Burch et al, 2006).

BLEU Algorithm Brief Description

To be able making the comparison between the reference text (*source text*), which is noted with *R* letter, and the *candidate text* (the one supplied by the MT system), denoted with *C* letter, by implementing the BLEU algorithm was needed to have the so called *n-grams*. The *n-grams* are groups of *n* consecutive words rated as units of measure. On this showing, *1-gram* means that a word is considered as unit of measure, *2-grams* means that two words are considered units of measures and so on (Papineni et al 2002; Callison-Burch et al, 2006).

As it is shown by Papineni et al in equation [1], to estimate the *BLEU score* it's necessary first to calculate the coefficient noted *BP* and named *brevety penalty* which is "[…] introduced to compensate for the possibility of proposing high-precision hypothesises translations which are too short." (Papineni et al 2002):

[1] $$BP = \begin{cases} 1 & if\ c > r \\ e^{1-r/c} & if\ c \le r \end{cases}$$

where: c is the length of the candidate text noted with C and r is the length of the reference text denoted with R (Papineni et al 2002).

The BLEU score is possible to be calculated with the equation [2] below (Papineni et al 2002):

[2] $$BLEU = BP * \exp\left(\sum_{n=1}^{N} w_n \ \log p_n \right)$$

where: N is the maximum number of grams considered and usually are used from 1-gram to 4-grams, w_n represent the positive weights and p_n represent the n-gram precisions (Papineni et al 2002).

The positive weights are calculated by equation [3] (Papineni et al, 2002). Callison-Burch et al consider that "The BLEU score can range from 0 to 1, where higher scores indicate closer matches to the reference translations, and where score of 1 is assigned to a hypothesis translation which exactly matches one of the reference translations." (Callison-Burch et al, 2006).

[3] $$w_n = \frac{1}{N}$$

As shown by Callison-Burch et al, Papineni et al have used equation [4] to calculate p_n, the n-gram precisions “for each n-gram length by summing over the matches for every hypothesis sentence *S* in the complete corpus *C* as:” (Papineni et al, 2002; cited in Callison-Burch et al, 2006).

[4] $$p_n = \frac{\sum_{S \in C} \sum_{n-gram \in S} Count_{matched}(n-gram)}{\sum_{S \in C} \sum_{n-gram \in S} Count(n-gram)}$$

where: *Count* is the maximum number of times a word occurs in a reference text (Payson et al, 2010).

Payson et al consider based on the definition given to Count that “[…] each candidate word count is clipped by its maximum reference count (MaxRefCount).” (Payson et al, 2010). Therefore the $Count_{clip\ (match)}$ is given by equitation [5] (Payson et al, 2010):

[5] $$Count_{match} = \min\left(Count,\ Max\,\mathrm{Ref}Count\right)$$

Using the above equations of the BLEU algorithm, the author of this paper has proposed an ITS which has applicability for the *Computers Programming and C Language* course, as it is taught at Petroleum-Gas University of Ploiesti. In the following chapters of the article are presented the most relevant aspects related to one specific model (part of the ITS models), the *tutoring model*, a model which is also dedicated among several other tasks to *students knowledge evaluation*.

The ITS itself has been developed using Java and MySQL and using the Web service for text processing supplied by the Artificial Intelligence Institute (AII) from Bucharest (http://www.racai.ro/webservices/TextProcessing.aspx) as part of using the Natural Language Processing (NLP) technologies within the proposed ITS. More details about the ITS structure, models, interface etc. are the subject of another paper (Dobre, 2013).

The BLEU Algorithm utilization for the students knowledge evaluation under an Intelligent Tutoring System

The tutoring model is one of the main components of the proposed ITS, being the link between student, teacher and system. The proposed tutoring model covers the following aspects of the learning-teaching-assessment-feedback cycle:

- *Supplies the course materials to students* – The students have unlimited access for the entire cycle period to the course lessons and tests;
- *Generates the questions and the questionnaires used to evaluate the student’s knowledge* – The tutoring model generates tests with ten questions each, all questions being generated from the lesson the student just reported as completed. There is a limited time for student to complete the test, which was set up to 10 minutes. The answers given by student are under text format. At the end of the allocated time the answers recorded on each question are automatically saved and the system, based on BLEU algorithm equations, calculates the score obtained and provides a personalized feedback to each student. Also, the results are reported in the student’s accounts and to the teacher. In figure 1 is presented a screen capture of one question as appears on the student’s screen. The number of questions as well as the time allocated can be both modified by the ITS administrator as considered necessary. The proposed ITS can generate two types of questions as follows: a) *questions of type 1*, which are the questions requiring like answers the enumeration of specific idea, concepts, features, properties etc. (an enumeration of words, delimited by comma); b) *questions of type 2*, which are questions not requiring like answer an enumeration. The acceptance criteria for the student is to obtain a score of 50 from a maximum of 100. In case that the passing score it is not achieved the student can’t continue to the next lesson and has to re-take the test. This can be

done after he repeat the learning cycle related to the test failed. When the student call for a new test a new set of questions it is generated by the system. The new questions are different from the ones generated at the previous test. In figure 2 is presented a screen capture showing the student screen view of the result obtained and the correct answers;

- *The answers evaluation* – the answers are evaluated by the proposed ITS in four steps as follows:
  - Step 1 – the text contained by the student answer is processed using the Web service for text processing supplied by the AII (http://www.racai.ro/webservices/TextProcessing.aspx). The text is split to phrase level, than to word level, the words are annotated morpho-syntactic, and, at the end for each word is obtained the word's lemma;
  - Step 2 – to the text generated by the system is applied step 1 as well and as result will be obtained the each word lemma;
  - Step 3 – applying the BLEU algorithm the words lemma from the candidate text and reference text are compared. Thus, the reference text annotated with *R* is considered the text consisting from the lemma succession obtained at step 1 and the candidate text, annotated with *C*, is considered the text consisting from the lemma succession obtained at step 2. For the questions of type 1 the proposed ITS is using the *1-gram* as unit of measure and for the questions of type 2 is use *2-grams* as unit of measure which means that in the case of the questions of type 1, the maximum number of n-grams considered, *N*, takes the value 1 and for the questions of type 2, *N* takes value 2.
  - Step 4 – for each question from the test, denoted *Intr*, is calculated the score using the equation [6]. The overall test score is calculated using the equation [7]:

[6] $$Scor_{Intr} = 10 * BLEU$$

[7] $$Scor_{Test} = \sum_{i \in Test} Scor_i$$

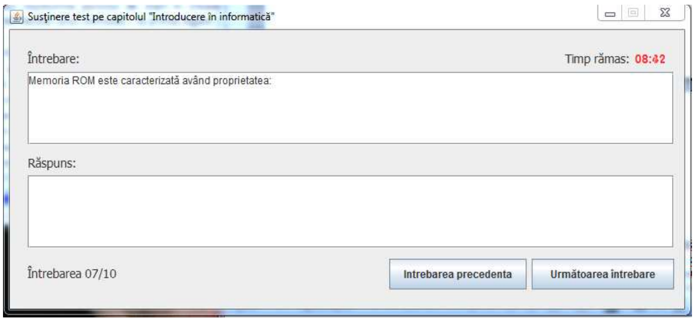

Figure 1. Screen capture presenting the manner how a question is displayed on the student's screen

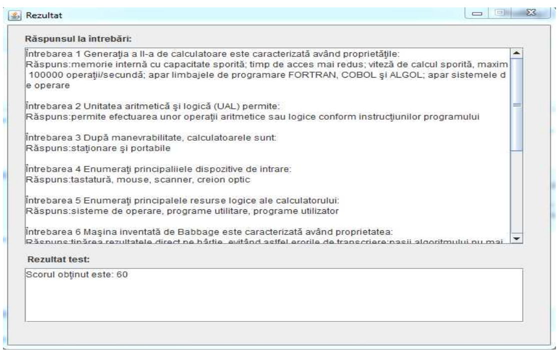

Figure 2. Screen capture presenting the student screen showing the result obtained by the student to a test as well as the correct answers

- *The historical representation of the results obtained in a time period* – For any lesson/s of the course the student can collimate all results to all tests she/he have taken during a period of time (days interval). The time period is identified to the system by the starting date and ending date and these data have to be introduced by the student. The student can monitor own results permanently. Also, the teacher can monitor the student's results and check, for example, for the trend of these. The information related to the results obtained is a very important feedback which can be used by all parties involved to sustain the continuous improvement of the system, of the skills and knowledge acquired as well as to personalize the instructional process according to the student needs and objectives. In figure 3 is presented a graph showing the student historical results (evolution) for a group of three tests taken in a period of time (days interval);
- *The tests centraliser* – The centralization of the tests is providing a graphic visualization of the results obtained to all tests from all lessons of the entire course. This is another important feedback which is provided to all parties involved and which can be used to conclude about the system performances, the course materials effectiveness, as well as about the student achievements and teacher skills & teaching strategies. In figure 4 is presented a screen capture showing an example of tests centralization.

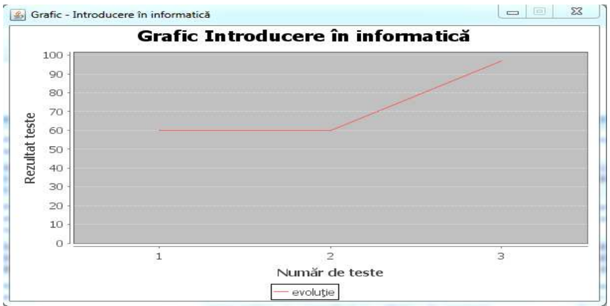

Figure 3. Screen capture presenting the student historical results (evolution) for a group of three tests taken in a period of time (days interval)

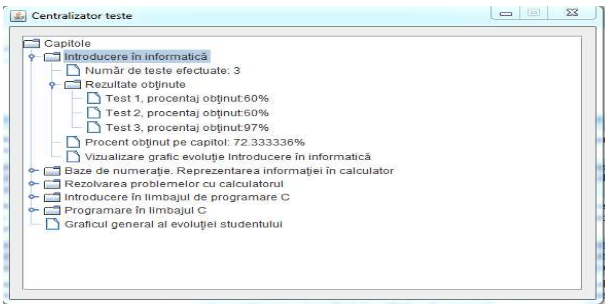

Figure 4. Screen capture presenting an example of tests centralization

Conclusions

The ICTs domination era has begun at a world wide level and at an incredible magnitude. There is no other option than to follow the path opened by the ICTs progress. The tools provided by ICTs development together with the human's decisive contribution in terms of modelling have shown a new direction for instructional process improvement. This direction is represented by the ITS.

The proposed ITS has as main targets to help both, students and teachers, to improve continuously and to reach the highest level of knowledge and skills. The tutoring model proposed has a series of advantages from the student's knowledge evaluation viewpoint which cannot simply be overlooked. Among all advantages which are financial, hardware and software, could be enumerated the following: low costs involved, software with public license used to develop the ITS, large range of hardware resources compatible with the use of the proposed ITS.

Also, the proposed ITS, from the point of student's knowledge evaluation available features, offers several valuable options such as: objective assessment, personalized and accurate feedback, less time consuming tests, trends visualization etc. But one of the major advantages which an ITS offers, and which is available within the proposed ITS as well, is the one highlighted by Nwana's paper where was cited the Bloom's comparison (Nwana, 1990). According to Nwana, Bloom has performed a comparison of the private tutoring against classroom instruction for cartography and probability discipline and Bloom "[…] found out that 98% of the students with private tutors performed better than the average classroom student, even though all students spent the same amount of time learning the topics" (Nwana, 1990; Bloom, 1984 cited in Nwana, 1990). Today, an internet connection, a communication tool (laptop, PC, tablet etc.) is present almost in the hands of all students around the globe. All these options available represent the features required by the ITS and by the private tutoring. All these options will lead to a change in the large interest of the mass and the author of this paper considers that ITS offer such chance for creating a different and better future for the instructional process and ultimately for the society itself.

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Using the Conceptual Map Method in the Teaching of Fundamental Concepts of Electromagnetism

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Abstract

This paper presents a conceptual map with resources for the teaching of fundamental concepts of electromagnetism starting from Maxwell's equations. The network of concepts is organized so that it emphasizes the deep connection between electromagnetism and other domains of Physics such as classic mechanics or the theory of relativity. There are highlighted the concepts that may constitute resources for the formation of a new conceptual map in connection to the main one, an example in this respect being the concept of electromagnetic waves. These developed maps aim at the elimination of certain obstacles met in the process of teaching and learning of electromagnetism.

Keywords: Conceptual map, Maxwell's equations, Electromagnetism, Electromagnetic field, Electromagnetic waves, Physics.

Introduction

A characteristic feature of the scientific knowledge is represented by the high degree of coherence and connection of the conceptual structures, and that is why a commonly accepted instruction method is to represent networks of concepts. Within these networks, there is clearly reflected the quality of the acquired knowledge and differences can be made between beginner and advanced levels (Koponen and Pehkonen, 2010).

A series of studies carried out at global scale and based on experiments on different batches of pupils and students demonstrate that the use of conceptual maps represents a way of completely monitoring the understanding of the scientific concepts by students.

The conceptual map as a constructivist type of learning instrument has been largely debated in the specialty literature and it need no further emphasis (Heywood, 1992; Okebukola and Jegede, 1988). A few practical pieces of advice on how to use conceptual maps as a way of monitoring how students grasp scientific concepts are given by J. Vanides and his collaborators (Vanides et al, 2005).

This paper presents a conceptual map destined to help in the teaching of the fundamental concepts of electromagnetism.

Aspects connected to the acquisition of the concepts from the electromagnetism domain have been treated in a series of articles in the specialty literature. There have been signalled a series of difficulties in students' understanding of this particular field of Physics and various remedial solutions have been proposed. We will further discuss some of the aspects treated in literature.

Problems connected to the understanding of the concept of field in electromagnetism are discussed by Igal Galili, after having tested high school students and future teachers of technologic subjects. In this particular study some of the difficulties observed are interpreted as coming from the changes in methodological approaches when moving on from mechanics to electromagnetism. According to the authors, clarifying the concept of field, including its historical aspect, proves to be useful in order to cope with the problems connected to the learning of the other concepts of electromagnetism (Galili, 1995). The same author, together with Dov Kaplan approaches aspects that aim at the teaching of electromagnetism in introductory courses of Physics at college level as for magnetic force, magnetic flow, Lorentz force and electromagnetic induction (Galili, 1997).

According to the study carried out by Esther Bagno and Bat-Sheva Eylon, the testing of students' acquisitions after a traditional high school course of electromagnetism at advanced level highlights three categories of understanding deficiencies: (a) the structure of acquisitions based on Maxwell's equations (qualitatively expressed); (b) the understanding of the relations between the electromagnetic field and its sources; (c) the relations needed in problem solving. In order to correct these deficiencies, there has been proposed a training model that integrates concept understanding, building the structure of acquisitions and solving problems. The focal activity for students was to build step by step a conceptual map organized around Maxwell's equations as basic relations of electromagnetism. This integrative model, compared to traditional teaching methods, has demonstrated that students who applied the method of the conceptual map were able to solve more easily Physics problems as opposed to those who followed classical methods (Bagno, 1997). Within this integrative teaching model, the same authors, together with Uri Ganiel, describe the MAOF program applied in Israel. The conclusion was that the students who studied with the MAOF program have considerably improved their understanding of the relations between general concepts and ideas connected to field and potential (Bagno, 2000).

The current paper shows how exactly fundamental concepts of electromagnetism can be taught within an introductory course of Physics at college level by building a conceptual map with resources focusing on Maxwell's equations. In this way, students' knowledge of electricity and magnetism are integrated, as well as knowledge of vectorial analysis necessary to operate with physical measures that intervene in this domain and at this study level. An example of resource, the concept of electromagnetic wave has been developed in a new map linked to the main one.

Theoretical background

The basic laws of electricity and magnetism can be concentrated, in a differential form, in four equations, as follows:

[1] $$\nabla \vec{D} = \rho$$

[2] $$\nabla \vec{B} = 0$$

[3] $$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$$

[4] $$\nabla \times \vec{H} = \vec{j} + \frac{\partial \vec{D}}{\partial t}$$

We have utilized the differential operator ∇ to express the divergence of the vector fields **D** and **B** in equations [1]-[2] and of the curl of the vector fields **E** and **H** in equations [3]-[4].

The sic measures that intervene in equations [1]-[4] have the following significance: **E -** electric field, **D -** electric displacement field, **B -** magnetic field, **H -** magnetic field strength, ρ **-** density of electric charge, **j -** density of electric current. Each measure is in accordance with position and time. The vectorial measures are in bold and this convention will be used throughout this paper.

The system of the differential equations [1]-[4], known as Maxwell's equations, allows the calculus of the four vectors that describe the electromagnetic field starting from the sources of the field represented by the measures ρ and **j**. Taking into account the fact that the equations [3]-[4] supply three scalar equations each when projected on the three axes of coordinates, thus results a total system of eight equations containing the components of the four fields **E**, **B**, **D** and **H**.

It must be stated that Maxwell's equations comprise the equation of continuity for the charge density and current density:

[5] $$\frac{\partial \rho}{\partial t} + \nabla \vec{j} = 0$$

This equation, valid at a macroscopic scale, results from equation [1] derived in relation with time, and then taking into account equation [4] (Jackson, 1998).

For the study of the movement of the charged particle, we supplement Maxwell's equations with the equation of the Lorentz force:

[6] $$\vec{F} = q\left(\vec{E} + \vec{v} \times \vec{B}\right)$$

where **F** represents the force that acts on the particle charged with the electric charge q that moves with the velocity **v** in relation to a reference frame in an electromagnetic field characterized by the vectors **E** and **B**.

The four vectorial measures that enter Maxwell's equations are not independent; they are connected by other measures that characterize the properties of the material. These connections constitute the constitutive equations and are written as follows:

[7] $$\vec{D} = \varepsilon_0 \vec{E} + \vec{P}$$

[8] $$\vec{B} = \mu_0 \left(\vec{H} + \vec{M}\right)$$

where ε_0 **-** vacuum permittivity, $\varepsilon_0 = 8{,}854 \cdot 10^{-12}$ F/m, μ_0 **-** vacuum permeability, $\mu_0 = 4\pi \cdot 10^{-7}$ H/m, **P -** electric polarization, **M -** magnetization.

In the case of a material that is linear, isotropic and homogenous from an electric and magnetic point of view, the relations [7]-[8] become:

[9] $$\vec{D} = \varepsilon \vec{E}$$

[10] $$\vec{B} = \mu \vec{H}$$

where ε represents the permittivity of the material and μ the permeability of the material.

In the case of a conductive material Ohm's law is valid, expressing, in a generalized way, the dependency of the current density to the intensity of the electric field and magnetic induction:

[11] $$\vec{j} = \vec{j}\left(\vec{E}, \vec{B}\right)$$

In particular, in the case of a linear, isotropic and homogenous conductive material in which the current density solely depends on the electric field, we have:

[12] $$\vec{j} = \sigma \vec{E}$$

where σ represents the electrical conductivity of the conductive material.

Having as a starting point Maxwell's equations, it can be easily demonstrated that an electromagnetic field propagates under the form of electromagnetic waves with the velocity given by the relation below:

[13] $$\nu = 1 \big/ \sqrt{\varepsilon \mu}$$

where ε and μ have the significance from the relations [9]-[10].

The validity of Maxwell's equations and the conditions of continuity in applying them in the case of separation surfaces of two different environments are largely debated in the specialty literature and need no further emphasis (Jackson, 1998; Vrejoiu, 1993).

Maxwell's equations form the basis of all classic electromagnetic phenomena. Together with Lorentz force equation and with Newton's second law of dynamics, these equations represent a complete description of classic dynamics for the interaction of charged particles and electromagnetic fields (Jackson, 1998).

„ Maxwell's Equations" Conceptual Map

The conceptual map for the teaching of Maxwell's equations, presented in figure 1, is built with the help of the program IHMC CmapTools. This program has been designed by "Institute for Human & Machine Cognition", a non-profit research institute from the University of Florida and it is part of a wide range of concerns of the researchers from this institute for the capitalization and extension of human capacities. The IHMC CmapTools program, can be downloaded free of charge from the IHMC website, permitting users to build conceptual maps in their PCs, share them on servers throughout the Internet, to establish links from their maps to maps on other servers, to automatically create web pages of conceptual maps on servers etc (http://www.ihmc.us).

The network of concepts belonging to the map is organized in several visual routes so that it makes it easy to assimilate notions of electromagnetism by the integration of electricity and magnetism pieces of knowledge.

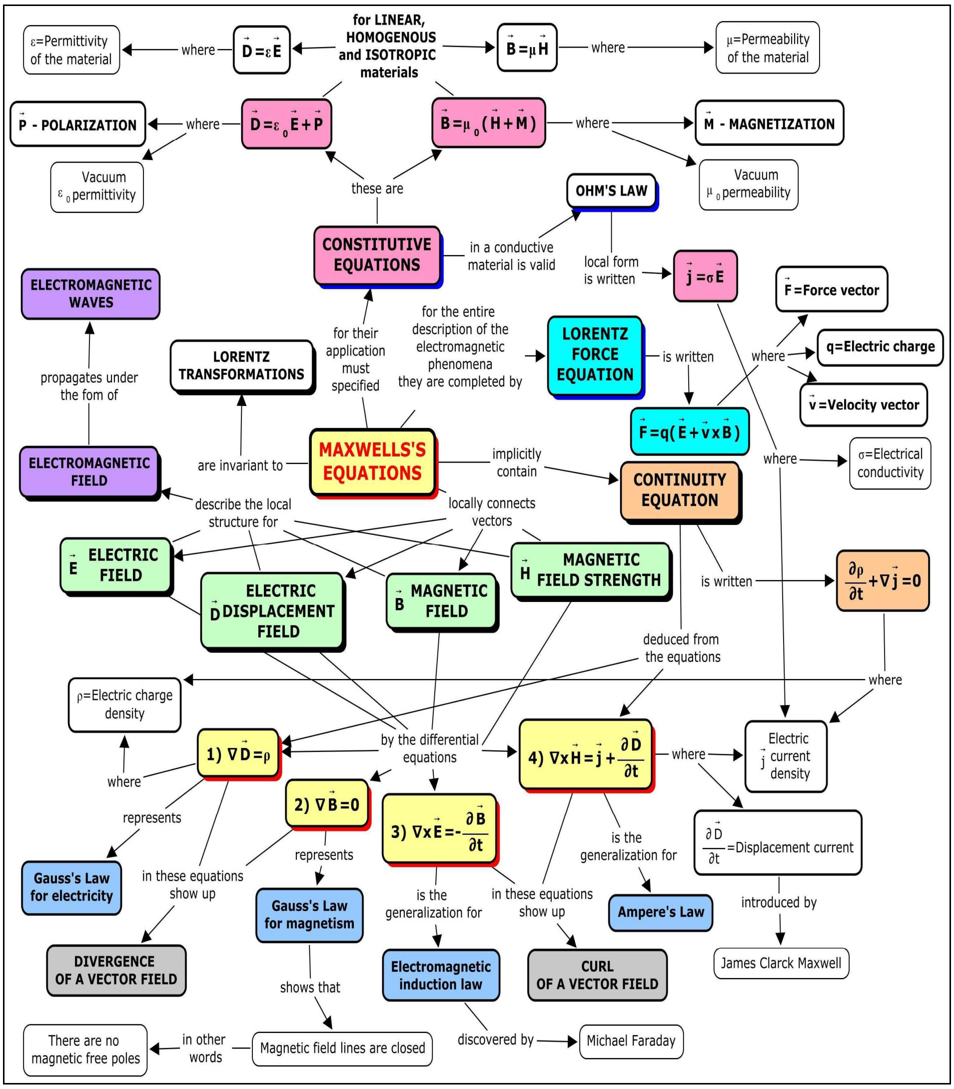

Figure 1. "Maxwell's Equations" Conceptual Map

The first route renders Maxwell's four equations with the physical measures involved and the fundamental concepts of electromagnetic field and electromagnetic waves.

It is specified that Maxwell's equations locally connect the vectors **E**, **D**, **B**, **H** whose significance has been previously explained, and these four vectors describe the local structure of the electromagnetic field that propagates under the form of electromagnetic waves.

From the concept of electromagnetic waves a map can be developed containing an entire network of other concepts in which we can state the classification of these types of waves according to different criteria, their transversal character, specific wave phenomena, the expression of the propagation velocity etc. In figure 2 the conceptual map "Electromagnetic waves" is rendered and it can be accessed from the map "Maxwell's equations" using the facilities offered by the CmapTools program. In their turn, the concepts belonging to this map can constitute new resources.

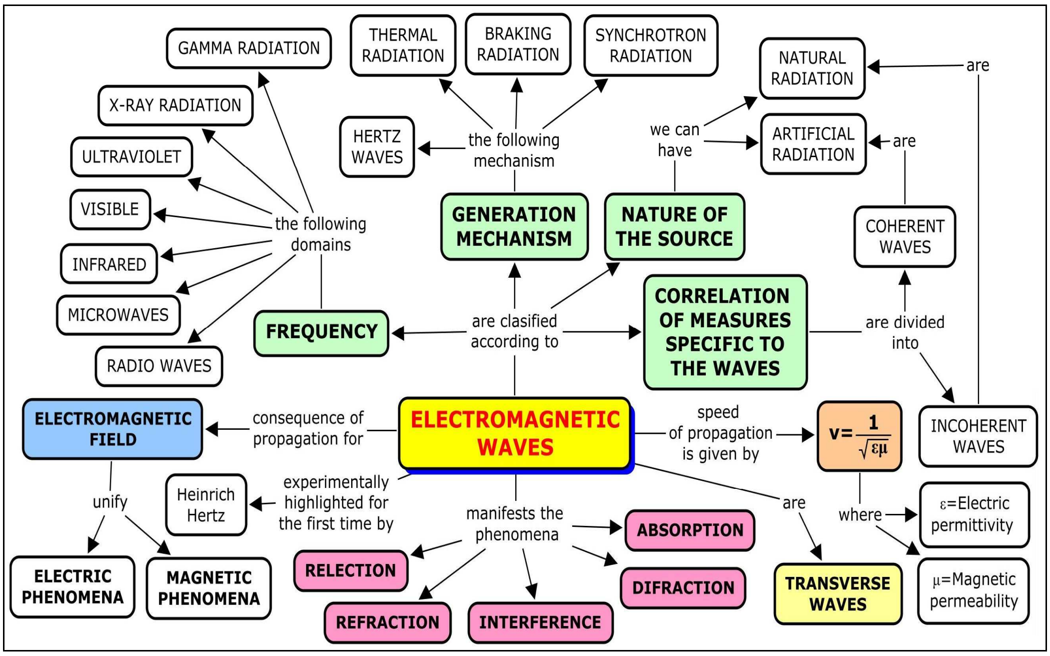

Figure 2. "Electromagnetic Waves" Conceptual Map

Also within the first route, it is highlighted the laws of electricity and magnetism and their generalization lead to Maxwell's equations. Thus, equations [1] and [2] represent Gauss's law from electricity, respectively magnetism, the second equation expressing the fact that a magnetic field always has the field lines closed, in other words there are no magnetic monopoles, equation [3] generalizes Faraday's law which describes the phenomenon of electromagnetic induction, whereas equation [4] generalizes Ampere's law through the introduction of the displacement current by J. C. Maxwell. Moreover, it is stated that in equations [1] and [2] the divergence of a vector field intervenes, and in equations [3] and [4] the curl of a vector field intervenes. Both the divergence and the curl are expressed with the aid of the operator∇, as a scalar product, respectively vectorial, between the operator ∇ and the vector fields **D** and **B**, respectively **E** and **H**. The concepts of divergence and curl have a fundamental significance in the vectorial analysis and that is why each can build the central element of a network of mathematical concepts.

The second route states the fact that Maxwell's equations implicitly contain the continuity equation that can be deduced from equations [1] and [4]. This equation sends a reference to the Physics of continuous environments.

The third route contains the constitutive equations needed to apply Maxwell's equations. The domain of the constitutive equations presents, on the one hand, the relation between the electric displacement field and the electric field, in which electric polarization also intervenes, and on the other hand, the relation between the magnetic field and the magnetic field strength, in which magnetization intervenes. It is stated that in the case of linear, homogenous and isotropic materials, the constitutive equations take a simple form given by the equations [9]-[10] where we have the measures connected to the environment, electric permittivity and magnetic permeability.

Also, the domain of the constitutive equations comprises a sub-domain that expresses Ohm's law. In particular, there is rendered the connection between the current density and the electric field. This sub-domain can make a reference to a conceptual map that approaches aspects linked to electric circuits.

The fourth route, the Lorentz force domain, by rendering the expression of the force acting on a charged particle in an electromagnetic field [6], makes the connection with the dynamics chapter from mechanics. This route completes Maxwell's equations for the whole description of the electromagnetic phenomena.

The fifth route ensures the link between electromagnetism and the Special Relativity Theory. It is stated that Maxwell's equations are invariant to Lorentz transformations. A conceptual map of Lorentz transformations has been presented by the authors in the paper "Constructivist Tools for the Study of the Special Theory of Relativity" (Grigore et al, 2013).

Conclusions

The conceptual map "Maxwell's equations" facilitates the teaching of concepts fundamental to electromagnetism. This map can be used both in teaching, and in learning or assessment.

Besides a well-developed network of concepts, its value resides in the exploration of certain elements that connect electromagnetism to the other domains of Physics. Thus, the concept of force makes a reference to Classic Mechanics, the concept of electromagnetic waves to Oscillations and Waves, whereas the concept of Lorentz transformations to the Relativist Physics. Moreover, it highlights crucial notions from the mathematical vectorial analysis which are necessary in the approach of electromagnetism at the level of an introductory Physics course at university.

The use of this map can lead to the consolidation and systematization of students' acquisitions, and also to their encouragement to use the CmapTools program as a powerful means of representation and information exchange. Also, it simplifies the renewal previous knowledge and the understanding of a vital chapter of Physics - Electromagnetism.

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Computer Programs

IHMC CmapTools

The Design of an Intelligent Tutoring System Using the Natural Language Processing Technologies

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Abstract

Today's society has increasingly more in need of learning techniques of high quality and, therefore, it has become increasingly clear the necessity to supplement the knowledge acquired by traditional means, taught by a teacher and using learning programs computer-assisted. The researchers performed in the Intelligent Tutoring Systems (ITS) represent a lever between artificial intelligence, cognitive science and education.

The main advantages of computer-assisted versus traditional tutoring are those that a computer never turn tired, the system is always available at any time and can be accessed by users from everywhere. In addition, compared with a classic computer-assisted tutoring system the ITS offers a personalised assistance and a real time feedback to the student, moulding itself on the student needs, and having as main purpose to enhance student's learning grade, such target being easily achieved by building the model of the individual.

The purpose of this paper is to present an ITS designed by using Natural Language Processing technologies. The ITS main scope is to assist the users in their learning process for the Computer Programming discipline.

Keywords: Computer-aided instruction, instructional system, Intelligent Tutoring System, Natural Language Processing, personalized instruction

Introduction

As it was presented by the author of this paper in the first report issued during the PhD program, the Information and Communication Technologies (ICT) have recorded an extraordinary progress in the past ten years. Such progress has lead to a real revolution in the computer-aided instruction field (Dobre, 2010). "Amid the rapid changes and the technological progress achieved, as well as the trend to globalization of the higher education and the disappearance of the boundaries between students, new perspectives have been opened for the instructional practice. Thus, the instructional practice has been fitted with new methods, tools, applications and modern teaching-learning-assessment technologies, which can be considered today specific to informational society." (Dobre, 2010).

The main advantages of the computer-aided instruction versus traditional instruction are many, the most important ones being the assurance of the instructional process continuity and of the universal access to instruction resources. Additionally, if a classic computer-aided instructional system is compared with an ITS, can easily be noticed that the ITS offers to student the option of a personalised instruction and of an immediate feedback about the performances achieved. Such options are available within an ITS due to the ITS capacity to adapt to the student needs being focused to support the increase of the student knowledge. The ITS adapting feature is made possible based on the modelling of the profiles of the individuals (students) who are using the ITS.

The scope of this paper is to present an ITS developed by the author of this article, using the Natural Language Processing (NLP) technologies.

What Is an ITS

As per Nwana definition the „Intelligent tutoring systems (ITSs) are computer programs that are designed to incorporate techniques from the AI comunity in order to provide tutors which know *what* they teach, *who* they teach and *how* to teach it" (Nwana, 1990).

In other words, an ITS is a package of programs capable to generate automatically and in an intelligent manner new instructional materials which will be introduced to student in conformity to his individual profile, needs and level of knowledge. Using techniques for automated instruction, the ITS is self-monitoring, self-assessing and self-improving its performances. Through the ITS any instructional activity could be initiated by any of the two, the student or by the system itself.

To develop an efficient instructional system it's necessary to use methods, technologies and tools from three different primary domains as follows: Computer Science, Psychology and Education, this being showed in figure 1 (Woolf, 2009).

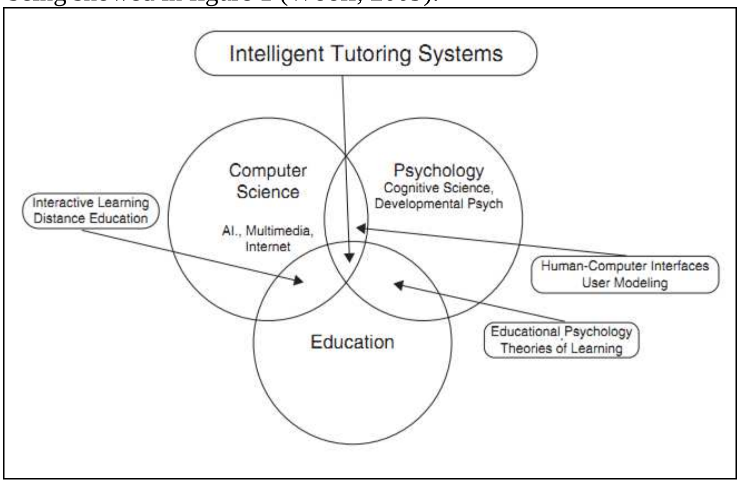

Figure 1. The development of an ITS using methods and instruments from three different domains (as presented in Woolf, 2009)

Each of the three domains have sub-domains which are contributing to the ITS development. For example, the Artificial Intelligence which, according to Woolf is a sub-domain of the Computer Science, contribute to the development of the *intelligent* features of the ITS. The Cognitive Science which is a sub-domain of the Psychology is contributing to the development of the *means* which will be used by students to process and assimilate the information received through the ITS. Meanwhile, the Education is used to find and to apply in the most efficiently way the most evolved methods for teaching-learning-assessment. The Woolf's three primary domains common intersection resulted from their interfingering (see figure 1) is considered by Woolf the birth place of the ITS (Woolf, 2009).

The ITS Structure

The ITSs paradigm is closely connected to the huge progress recorded by the knowledged-based systems, called also *expert systems*. Starting from expert systems the specialists in instructional systems were looking to develop a new system, fitted with an explicit knowledge base, and which could be used in a different context than the one for which was built. This different context targeted by specialists was the instruction of the *novices*. The specialists considered to add some specialised modules to an expert system so would be possible to transfer knowledge (and implicitilly competence) from an expert to a novices. In a such case the system could be considered an intelligent system and the system will get smart instructional meanings (Ştefănescu, 2006).

This vision led to the building of a architectural structure which is typical to ITS. Such structure is consisting from four macro-environments as it's presented in figure 2 (Nkambou et al., 2010).

According to researchers (Nkambou et al., 2010; Trăuşan-Matu et al., 2005; Nwana, 1990; Self, 1988), the four macro-environments are in fact models described as follows:

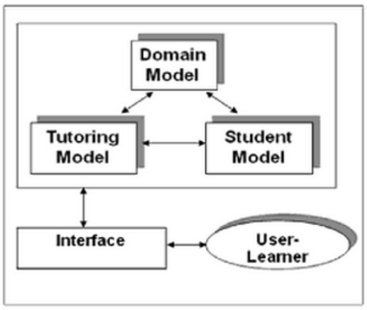

Figure 2. The ITS architecture (as presented in Nkambou et al., 2010)

- *domain model* – contains concepts, definitions, rules from the learning domain, as well as strategies to approach the solving of the exercises and problems, base on which will be performed the student performances assessment, will be identified all mistakes and will be generated a personalised feedback. The knowledge-base of the learning domain could be represented in several modes with the support of ontology, hierarchies, semantic networks, frames, production rules (Trăuşan-Matu et al., 2005);
- *student model* – is containing aspects about student as follows: the initial knowledge and the knowledge acquired during the instructional process, the student's personal data, the student's performance evolution during the instructional process, information about student emotional and affective state. In some situations, the student's knowledge base is included in the domain's knowledge base. The importance of the student model in the ITS architecture has been highlighted by Self in 1988, when Self has defined the six major roles played by student model these being: corrective, elaborative, strategic, diagnostic, predictive, evaluative (Self, 1988 cited in Nwana, 1990);
- *tutoring model* – is the model that contains the learning and teaching strategies, examples and analogies. Based on the information provided by the student and domain models, the tutoring model choose an action, a strategy, a pedagogical technique or a combination of actions, strategies or techniques which could help the student to assimilate the maximum of information & data;
- *communication model* – is in fact the system interface with which the student could communicate with the computer.

In order that an ITS to be effective, the ITS has to be fitted with a very extended knowledge base of the domain targeted, and the pedagogical strategies used to assist the student during the instructional process must be more varied and more personalized so the needs of the student will be fully covered. It also has to make possible a permanent connection between student and tutor (teacher) in a manner that this connection will become a mean through they can communicate.

Description of the Proposed ITS Architecture

The proposed ITS architecture is based on the one proposed by Nkambou et al. and shown in figure 2 (Nkambou et al., 2010). The author of the present article has looking more to the practical side of the problem and keeping same ITS architecture has focused on the materialisation of the ITS using tools available on the Web and having public free licenses. More over, the author has chosen as domain of applicability the *Computers Programming and C Language* discipline.

The idea was to develop an ITS capable to assist through the entire instructional cycle (teaching – learning – assessment) those students who want to take onboard and to understand notions about Computers Programming and C Language. Another idea followed when the proposed ITS was developed was that the system should be capable to follow up the student evolution based on the results obtained during the assessment phases. Briefly, the assessment part was developed based on tests with questions to which the students have to answer in text format. The ITS is analysing the answers provided by the students using the NLP technologies and generates a personalised feedback to each of them.

The ITS proposed was developed using Java and MySQL together with the Web service for text processing made available by the Artificial Intelligence Institute (AII) from Bucharest (http://www.racai.ro/webservices/TextProcessing.aspx).

The Domain Model

The proposed domain model contains the knowledge base specific to Computers Programming course as it is taught in the Oil-Gas University of Ploiesti. Here have been stored all the information pertaining to this course in order to provide the student with the required knowledge.

The knowledge base from the domain model and specific to Computers Programming course covers topics as follows: the evolution of the computing systems, the phases of a program execution, numeration bases, solving problems assisted by computer, elements, instructions and other aspects related to C Language.

The information stored in the domain model will be used later, during assessment phase, to generate the tests questions and to perform the analysis of the answers provided by the students, as based on this analysis will be calculated the scores and a personalised feedback will be generate and sent to students at the end of each assessment session.

The Student Model

The second module, the student model, identifies and memorise the information about the student: personal details, the student evolution up to date, the taken tests and the scores obtained. All information from the student model are updated permanently based on the progress recorded and all the information available at one moment are used to create the personalized feedback sent to each student. Also, the information stored start from the time when the student register within the ITS using the registration interface.

The proposed student model stores the following categories of data:

- *Student's personal data & registration* – figure 3 illustrates which personal data are stored in the student model. These data are collected and stored from the first login done by the student. A graphic interface is used to collect these data and also, the interface is fitted with an option allowing the student to carry on any modification deemed necessary to be done. The data submitted are protected from any non-authorized access through a password given by student. As traditional for online access systems, the user name and the password are required by the ITS to recognize the student. Additionally, the system will require to choose between user and administrator level as the ITS access graphic interface it is used also by the system administrator. The student e-mail address is another mandatory information to be provided as the student e-mail address will be used to exchange important data and information (i.e., user registration confirmation, informing messages about aspects/topics/issues etc.). Figure 4 is showing a test example for user registration confirmation;
- *Student's results after taken the tests* – the students are assessed by the ITS after each course stored in the domain model is completed. The scores obtained by the students are recorded in the student account created within the student model;

- *Student's evolution history* – the student model is storing valuable information about student evolution during the instructional cycle such as: number of courses completed, number of tests taken, the scores obtained etc. The data are recorded after each course is completed and the attached test is taken by the student. Also, the ITS has the option to create graphs for a better understanding of the student's evolution such as the graph of the results obtained calculated between two dates as requested by the solicitor. Also, overview (general) graphs can be created to have the picture of the student's evolution at macro level at a desired moment.

Tutoring Model

The proposed tutoring model has been developed in a manner consider by the author of this article as an attractive one focusing also to have set up a systematic organization and having as final target to connect the student as user of the ITS with the instructional process respecting in the same time the student needs.

The tutoring model stores the following categories of data:

- *Course materials* – the students have at disposition all courses contained by the Computers Programming and C Language curriculum as it is in used at Oil-Gas University from Ploiesti. The graphic interface is easy to use and as it is shown in figure 5 offers to the student the option to start with the very first chapter by just selecting that one from the list but also offers the possibility to come back to any of the previous chapters as student deemed necessary;

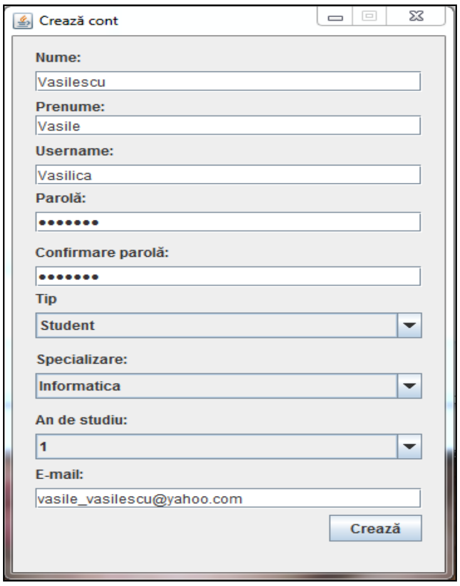

Figure 3. Screen capture of the graphic interface – data page showing one fictive example of registration

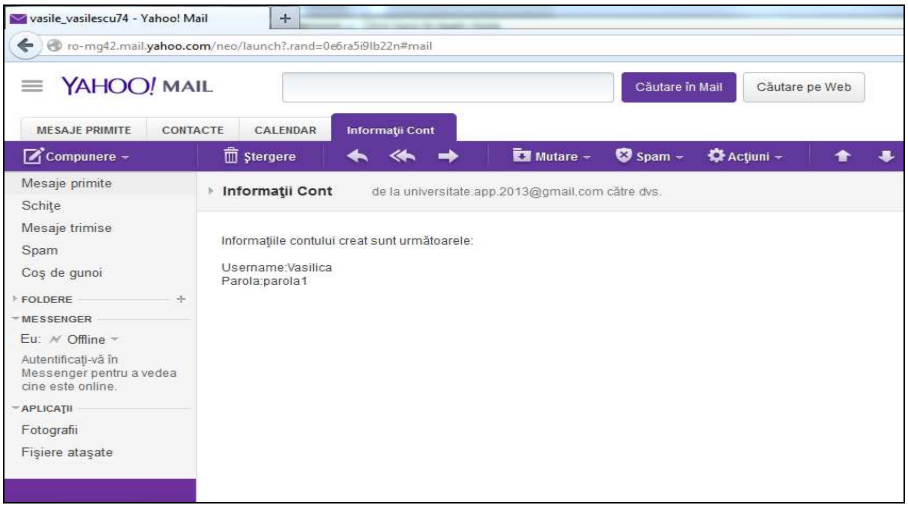

Figure 4. Screen capture of the graphic interface – data page showing one fictive example of registration

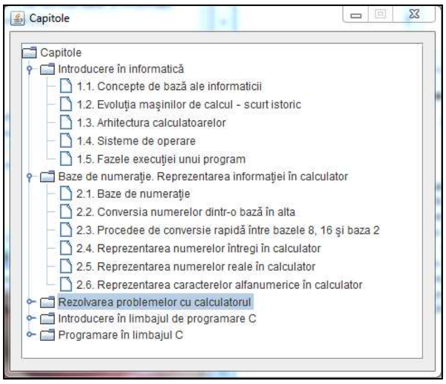

Figure 5. Screen capture of the graphic interface used to access the course

- *Tests generation* – after each chapter the tutoring model is generating a test with ten questions from the chapter completed by the student. There is set up a time limitation for student to answer. The time allocated as well as the number and the content/difficulty grade of the questions could be modified by the system administrator as necessary. The questions are generated randomly;
- *Student answers analysis* – the students answers are analysed by using the AII Web text processing service (http://www.racai.ro/webservices/TextProcessing.aspx). The service compare the students answers versus the correct answers stored by the teacher in the system. The comparison of the answers is done using the BLEU algorithm (Papineni K. et al., 2001). The ITS has set up a minimum percentage of correct answers which shall be provided otherwise the student will not pass the test. There is the option to repeat the cycle and re-take the test at the end;
- *Tests summary* – the personalized feedback is provided either through graphs either through recap of the taken tests. The feedback is constructive and is continuously provided to both, student and teacher.

Communication Model

The communication model is in fact the ITS interface and was developed to be as much as possible attractive and systemically organized in order to be user friendly.

Conclusions

The author of this paper considers that the future of the instructional process belongs to ICT and to ITS. There is continuously increase in demands of hardware and software implementation in all organizations involved in instructional process. Higher education is not making any exception from this mega trend and therefore, all higher education organizations shall be prepared to sustain the development and the implementation of the ICT and ITS within their curriculum regardless the specializations and the disciplines.

In this paper the author has briefly presented a proposal of an ITS built in respect of the ITS classic architecture as presented by Nkambou et al. (Nkambou et al., 2010). The proposed ITS is using the text processing service provided by AII which is based on NLP technologies and on the BLEU algorithm. The author is still working to finalise all details regarding the proposed ITS and to have it ready for the testing phase, which is the next step which will be taken in the short future.

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Designing E-Learning Courses Using Lectora

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Abstract

In the context of the actual development of the education tools, e-learning seems to be the most exciting way of making the courses more accessible, attractive and efficient for the students. A series of software tools were developed in order to support and aid teachers and students to adapt to the new demands of e-learning. Lectora represents an e-learning development tool used to create online courses, assessments and presentations. This paper presents an approach of designing e-learning courses using Lectora in two separate teaching fields: Introductory elements in graph algorithms and Introductory elements in Java. An detailed analysis of the advantages and disadvantages for the students and teachers is presented.

Keywords: E-learning, Education Tools, Lectora

Introduction

The actual development of the education tools asks for new ways of making courses more attractive and efficient for the students. In this context e-learning seems to occupy an important role in the development of this education tools.

The task of education and training based on new information and communication techniques is not to demonstrate that it has immediate results in a race with other education systems but to replace some of the existing structures with new ones, probably with a higher spectrum performance, to adapt to the changes that occur in culture and civilization (Istrate, 2000).

At the present time a series of different tools were designed in order to facilitate the design of e-learning courses. One of this software instruments is Lectora, a tool designed by Trivantis Corporation Inc.

Lectora is a powerful tool that can be used in the e-learning field and it offers a series of advantages for the teachers and students. In this paper is presented an approach of designing two e-learning courses in two different fields using Lectora. The name of the first course is “Introductory elements in graph algorithms” and the second is called “Introductory elements in Java”. A detailed analysis of the advantages and disadvantages for the students and teachers is presented.

E-Learning

An E-Learning system consist in a planned teaching-learning experience organized by an institution that provides the material environment in a sequential and logic order to be acquired by students in their own way, without forcing the activity agents to co-host or to synchronize. The mediation between students and teachers is done through various ways, from a CD material to the technology of transmitting contents over internet (Istrate, 2000).

The e-Learning notion is usually considered synonym with Online Learning, Web Based Learning – WBT or Distance Learning. In this context a possible description of e-Learning is based on the following considerations (Timsooft, 2012):

The learning process is accomplished in a virtual class and the educational material is available on the Internet;

The virtual class benefit of the orientations given by an instructor which can plan the group activities, propose debates over several aspects of the course, gives auxiliary resources for learning, corrects the homework and gives feedback for each student;

The learning becomes a social process considering the fact that the instructor and the students form a virtual community, consolidated by collaboration and interaction.

The course material presents an static compound (the course prepared by the instructor in collaboration with a team specialized in instructional design) and a dynamic compound (resulting from the students interactions).

E-Learning means the access to the newest information, achieving new knowledge, continuous learning with new and efficient methods (Timsooft, 2012): The traditional system of learning is organised by age groups. In opposition, the online learning is organised by subject groups: at the same online course can attend students of different ages, experience, from different places, each course is unique, making of the participation a true life experience.

Lectora Inspire

There are several software tools that can be used in order to develop an E-learning course, such as Articulate, Captivate and Lectora. All three programs are capable of creating engaging and interactive e-learning modules. Regarding the costs and the intuitive interface, Captivate is inexpensive but may be difficult for new users. Articulate and Lectora are more expensive but easier to use and may be better options for new users.

Relating to the way some features, like video and image capture, work, in Captivate and Articulate these are native to the programs whereas Lectora launches external applications, like Camtasia, Snagit, and Flypaper, from within the program. “Both, Captivate and Articulate offer a clean capture that automatically eliminates erroneous mouse clicks during the recording process while at the same time adding callouts. The same end result can be accomplished in Lectora but it requires manually adding callouts by "marking" the clicks that require additional explanation (Voices, 2012).

According to Thomas Toth, everything Articulate and Captivate does, can be done in Lectora (Thomastalkstech, 2012). Lectora is a user-friendly authoring tool, that is self-contained and functions independently, used to develop rapid, highly engaging and interactive eLearning courses (Commlabindia, 2012).

One of the advantages of using Lectora is that it has highly customizable Templates, Interactivities and Quizzes, and it makes the user less dependable on external software resources, because it incorporates additional tools such as an image editor, audio and video editor.

Another advantage of using Lectora is that it does not require programming skills such as HTML, CSS or Javascript to develop the courses. According to Abdul Razzaque Hussain, eLearning courses developed and published in Lectora are supported by multiple browsers and can have multi-lingual support. In the newest version, courseware that is compatible with section 508 can be easily prepared and published on the Web. All video controller buttons can now be read by screen reading software. There is also another feature where one can check if all images and buttons have alt tags (Commlabindia, 2012).

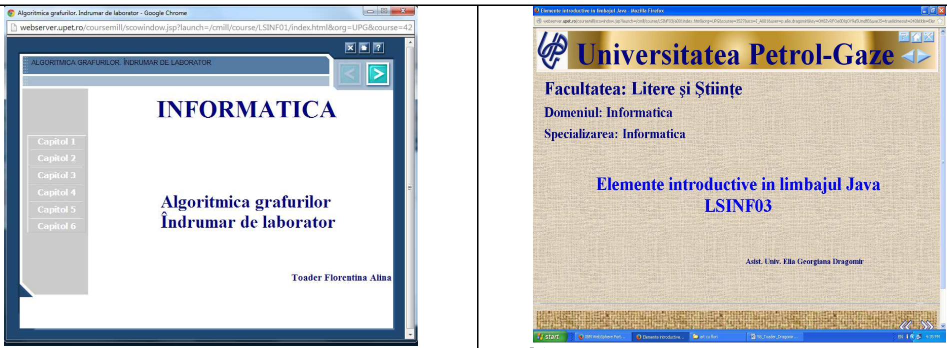
Therefore, these are some of the benefits that we considered when we choose Lectora in order to develop our eLearning courses.

E-Learning Courses Using Lectora

Lectora Inspire represents a complete eLearning solution for education and training organizations with build-in resources for rapid eLearning development. In the following section there are presented two examples of courses built with Lectora software, the trial version (Trivantis, 2011).

The first Lectora course is called “Introductory elements in graph algorithms” and is designed for the students of the Petroleum Gas University of Ploiesti. This course presents an introduction into the graph algorithm field, containing the description and definition of the basics elements of the graph theory and the most important algorithms that are used in this field.

In order to obtain an attractive and efficient course, that is easy to assimilate by the students, Lectora tools were used. The user interface of the proposed course is presented in figure 1.a.



a) b)

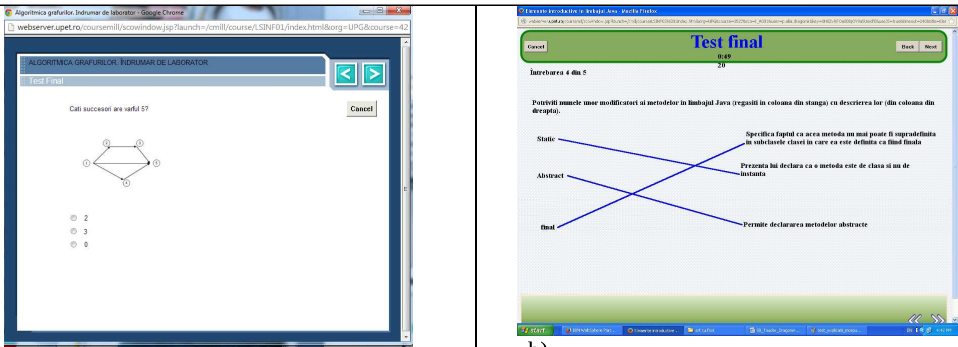
Figure 1 a) User Interface of the “Introductory elements in graph algorithms” course; b) User Interface of the “Introductory elements in Java” course

The course is structured in 6 chapters as follows: Introduction in Graph Theory, Minimum Paths Algorithms, Minimum Costs Algorithms, Colouring Algorithms, Transport Networks, and Tests.

Each of the chapters is designed to make the learning experience enjoyable and interesting; all the theory parts are followed by graphic example in order to easily understand the presented notions.

In the last chapter there are a series of evaluation test that the students can use to evaluate their knowledge in the studied field. If the test result is not the expected one, the students can study more and return to the test when they are more prepared for this.

The interface of the test module is presented in figure 2.a.



a) b)

Figure 2. a) Test Interface of the “Introductory elements in graph algorithms” course; b) Test Interface of the “Introductory elements in Java” course

The second course developed with Lectora is “Introductory elements in Java”. The user interface of the proposed course is presented in figure 1.b. This course is also designed for the students of the Petroleum Gas University of Ploiesti and is structured in 6 parts: ABC of the Java language, Instructions, Arrays, Strings, Objects and Classes.

It focuses on the basic elements of this programming language, such as some definitions and examples for variables, constants, arrays, strings. The main instructions (decision instructions, repetitive cycles, exceptions handling instructions) are also presented in the course. Regarding the fact that Java is an object oriented programming language, elements like class, super class, subclass, object, attributes, methods, inheritance mechanism are tackled in the 6th chapter.

After reading the chapters of this course the student has the possibility to evaluate their knowledge using the final test. Test interface of the “Introductory elements in Java” course is presented in figure 2.b. At the end, the student either has pass the test, if 50% of the questions are correct answered and a congratulation message is displayed (figure 3.a), either has fail the test and a message is shown (figure 3.b).

After using Lectora to design the 2 presented courses, a series of advantages can be highlighted:

- Lectora is a simply to use software in order to design E-Learning courses;
- The user interface is friendly and it allows a quickly development of the course by accessing the templates available, by easily attaching files and automatically generating the content list;
- Multiple test types are available: multiple choice, true/false, drag and drop, essay;
- The e-learning courses represent a viable alternative for the classical one;
- Each student can learn in his own speed, can return to certain information in the past any time he needs.
- The course is available online, anytime and anywhere so no travel costs are involved;

a) b)

Figure 3. a) Test Interface if the test is passed;
b) Test Interface if the test is failed

There are also a series of disadvantages referring to the fact that designing an online course using Lectora is more expensive that designing a traditional course and the efficient use of this courses requires that the student has a computer that meets the hardware and software requirements and an Internet connection.

Conclusions

Lectora is great software to use if you are planning a presentation or preparing for a project. In this test case we have created two different eLearning courses using Lectora. Being a simple to use software that has a user friendly interface we found that it has many advantages as well for the teacher as for the students.

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The Vee Heuristic Applied for Teaching/Learning Hydrogen Atom in High School

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Abstract

This paper proposes a visual approach to the study of hydrogen atom at the high school. It provides a basis for both theoretical and conceptual content, but also for knowledge analysis, processing and interpretation or reflection. There are many benefits to using Vee diagram by students. It helps to see the connection between what they already know and the new knowledge they produce or try to understand. It has psychological value since encourages learning not only effective, but also helps to understand process in which people construct knowledge. The connection between knowledge and learning is quite evident if the conceptual maps are used explicitly as part of Vee diagram.

Keywords: The Vee diagram, Conceptual map, Cognitive learning theory, Meaningful learning, Physics, Hydrogen atom

Introduction

Conditions everyday reality requires a transformation of traditional methods that the teacher is a transmitter of information. The student is a passive receiver equipped eventually with capacities, skills and available skills at school and less in its future evolution. Learning cannot be solely the result of teacher approaches. Testing and evaluation must not only intelligence test or exam.

It is a clear need for major transformation of classical education. It is rigid, based on mechanical memory and rudimentary education. It must be transformed into a modern, creative, intelligent, participatory and collaborative, in which teachers and students together construct knowledge, deep understanding of the subject / phenomenon studied giving each other feedback, so necessary for both parties.

Physics curriculum calls for training the following skills (Curricula for Physics, 2006):

1. Understanding and explanation of physical phenomena of technological processes, the operation and use of technology products encountered in everyday life.
2. Scientific inquiry applied to experimental and theoretical physics.
3. Communication.
4. Protect ourselves, others and the environment.

Share learning activities that can promote the formation of these skills, such as experimental investigations, case studies on real problems, scientific methods of documentation, research of a concept or phenomenon, is reduced.

The causes are multiple: the small number of Physics hours, general disinterest in pupils' learning, especially for difficult subjects such as Physics, transforming classrooms laboratories, equipment nonexistent, outdated or inoperable, inadequate content of the curriculum and textbooks. For physical discipline, 12th grade is the hardest.

This paper proposes a new approach for Models of atomic and quantum transition from qualitative analysis of emission spectra, continuing with particular study of the hydrogen atom. Obviously, for a number of hours greater than currently assigned classroom for students to have access at home, all content will be integrated visual, on an a collaboration space designed specifically for this task.

What is it and how to use VEE diagram?

Vee diagram is so called because its shape of the letter "V". It is also called Gowin’s Vee (V), knowledge Vee and Vee heuristic (Novak and Gowin, 1984).

It provides a visual structure for an experiment or study, providing a basis for both theoretical and conceptual content, but also for analysis, processing and interpretation and reflection. Figure 1 is a schematic representation of it. Central to above, starting with the one or more focus questions made in this study. Along the left side is continuous with the theoretical and conceptual information, a concrete experiment, study, or experience at the point of the V. The analysis and evaluation of the experiment in light of the focus question is along the right side.

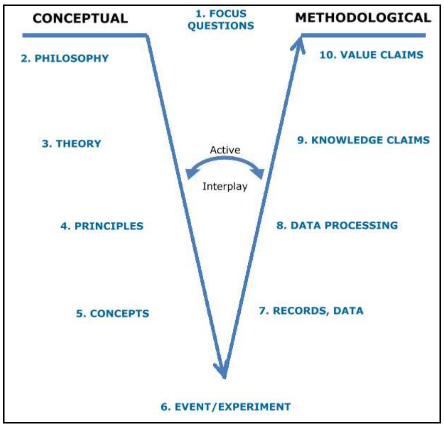

Figure 1. Basically structure of Gowin's Vee heuristic used as template

It was called the Knowledge Vee Heuristic diagram of Gowin, after the name of which, in 1977 (Åhlberg, 1993). It was invented to illustrate the conceptual elements, and methodology interacts in the construction of knowledge, or in analyzing the studies and documents presenting knowledge. Initially, it was developed for use in science classes and highly appropriate to help students to better understanding of a subject / phenomenon by viewing the overall educational approach. Later, it became a quality tool to construct and improve what, why and how to learn, and how we succeeded in it (Åhlberg, 1993). Thus, the Vee diagram is a suggestion to say why we are doing an inquiry, what we are planning to do, and to express the value basis of our acting. Vee diagram is also useful for teachers to plan and conduct a study or experiment, and evaluate students' reports or essays. Steps or missing information become apparent (Novak and Gowin, 1984).

The production of knowledge or interpretation all the functions interactively with each other, the two sides to sense the event or observed objects. Students participating in a laboratory class are concerned with making measurements, data processing, graphics, and comments, even to draw conclusions, most often without knowing why they do it (Ausubel, 1963). Rarely one student, deliberately invokes the relevant concepts, principles and theories that lead him to understand what he noticed / discovered, it is correct or not. That's because students are not aware guided conceptual or theoretical ideas as scientists in their research. There is no active inter-relation between the thought and the Vee's left to do, right. The result is often disappointing.

There are many benefits to using Vee diagram by students (Ausubel, 1978):

Help them see the connection between what they already know and the new knowledge they produce or try to understand. It has psychological value since encourages learning not only effective, but also helps to understand the process in which people construct knowledge.

The conceptual maps are used explicitly as part of Vee diagram, the connection between knowledge and learning is very evident. It is worth trying and testing in practice.

Spectrum of the hydrogen atom

The approach covered in this lesson started with the presentation of some of the basic results of quantum theory in order to obtain the energy levels of the hydrogen atom, explaining the cause of its spectrum observed experimentally.

For the experiments, we used a mass spectrometer and gas discharge tubes, plus a high-voltage source (Figure 2) (AlfaVega, 2006)

Also, for a better viewing comparative front, we used a flex camera to project the images formed by the spectrometer on a whiteboard / screen (Figure 3) and a camera lens good enough that we managed to shoot some pictures directly from microscope spectrometer (Figure 4).

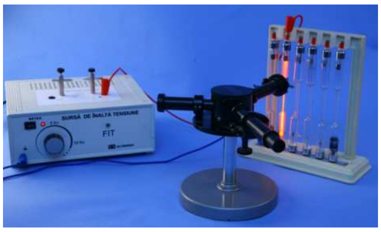

Figure 2. Experimental devices

Figure 3. Supplementary devices, a flex camera to project the images formed by the spectrometer on a whiteboard

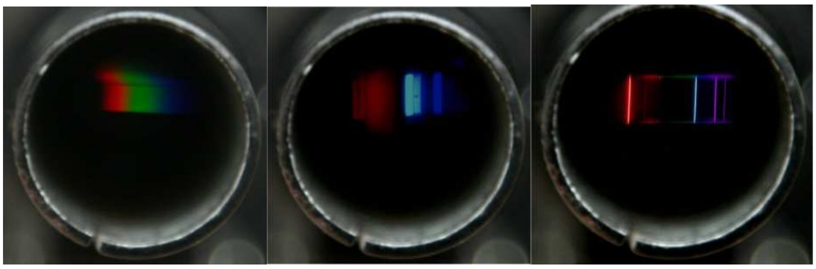

Figure 4. Photos of the hydrogen atom spectrum taken directly from microscope spectrometer

Using CmapTools, Concept Maps and VEE diagram in physics lesson

For the practical part, we used the concept map and Vee diagram constructed with CmapTools software tool developed at IHMC (Institute for Human and Machine Cognition) (Cziprok *et al*, 2013).

The students, in the final year of high school, involved in this educational approach, are familiar with the use of this program and already have experience in the construction of conceptual maps. They are also accustomed to working in teams and complete laboratory work with a report. After being presented the structure of Vee diagram, it was suggested this new approach to their final report.

Of course, the structure in Figure 1 is indicative. Some items can be replaced or eliminated, even renamed educational approach based on the existence, or not of these elements, priorities or other reasons. But five elements should not miss:

Question / Focus questions

There are the epistemological elements that we regard as essential for understanding how humans make sense out of their world. Focus Questions are essential for this. So the students were asked to make them their own, let them choose the most relevant and have been inserted into the template at the top centre. What is and how to, are usually the most common and simple questions.

For our lesson about hydrogen atom were chosen: What are the basic features of quantum mechanics? How to apply quantum model of the hydrogen atom? What are energy levels? How to explain atomic spectra?

Event / Objects and phenomena observed

This element underlies the implementation of the planned approach. In our case, it is the experimental study of the hydrogen atom. Specifically, what did we do in order to answer the focus questions? First at all, the qualitative experiment to visualize the spectrum of the hydrogen atom. We took pictures of the experimental device, the light emitted by the discharge in hydrogen gas, and also the spectrum directly in front of the microscope. Then, the students had to do research and read scientific literature to construct concept maps and analyze and synthesize the information collected. The Figures 5 and 6 are examples of conceptual maps made to facilitate the research. Many others can be viewed in the final Vee diagram, attached as resources.

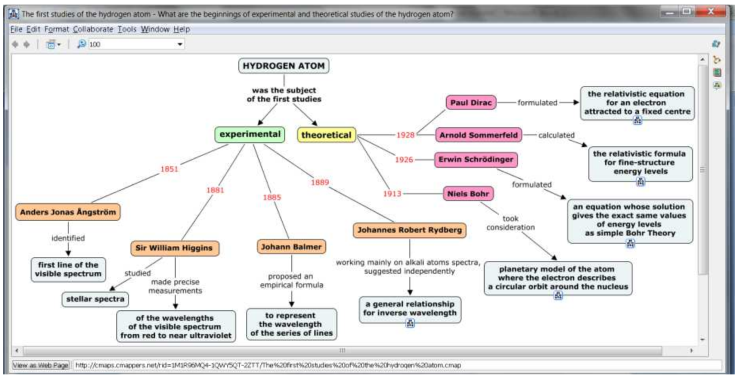

Figure 5. The first studies of the hydrogen atom – What are the beginnings of experimental and theoretical studies of the hydrogen atom? (http://cmaps.cmappers.net/rid=1M1R96MQ4-1QWY5QT-2ZTT/The%20first%20studies%20of%20the%20hydrogen%20atom.cmap)

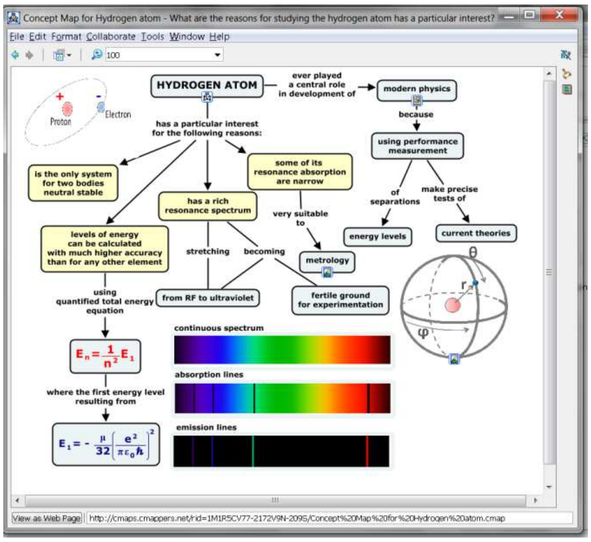

Figure 6. Concept Map for Hydrogen atom –
What are the reasons for studying the hydrogen atom has a particular interest?
(http://cmaps.cmappers.net/rid=1M1R5CV77-2172V9N-209S/Concept%20Map%20for%20Hydrogen%20atom.cmap)

Theory, principles and concepts

In the early 20th century, many scientists have contributed to the Theory of Quantum Mechanics, which helps explain the mechanics of movement and entities very small, enabling the discrete nature of the energy. Quantum mechanics has become the predominant theory of atomic movement, providing good explanations for many phenomena observed, which could not be explained by classical mechanics (Garabet *et al*, 2012).

Records, data processing

Using quantified total energy equation [1], where the first energy level is given by relation [2], students calculated the energy values for the first 10 energy levels of the atom hydrogen.

[1] $E_n = \frac{1}{n^2} E_1$

[2] $E_1 = -\frac{\mu}{32}\left(\frac{e^2}{\pi\varepsilon_0\hbar}\right)^2$

[3] $\mu = \frac{m_e \cdot m_p}{m_e + m_p}$

Where, μ is reduced mass, by relation [3], with ??m??$_e$??the mass of the electron and m_p the mass of the proton; e, the elementary charge; ε_0 the vacuum permittivity; ħ?? the reduced Planck constant.

Result the value of the lowest energy level, known as ionization energy of hydrogen, a value confirmed by experimental evidence that Lyman series limit:

[4] $E_1 = -2{,}1786864 \cdot 10^{-18}\mathrm{J} = -13{,}598292 eV$

According to quantum mechanics, there is an infinite number of energy levels, $E_\infty = 0$. Also these energy levels are (with a good approximation) independent of any other number except n quantum, such as l and m, because the hydrogen atom has only one proton and one electron, with opposite charges and equal, without any interference (http://www.physics.drexel.edu/~tim/open/hydrofin/hyd.html).

Value added knowledge

Finally, some conclusions were reported by students:

Quantum mechanical explanation is great for many observable phenomena that could not be explained by classical mechanics.

Energy levels of the hydrogen atom calculated agree with the experimental data and the energy levels of the hydrogen atom depend, with a very good approximation, only on the principal quantum number, n;

Result of passing of the electron energy level of an excited hydrogen atom, a lower level is equivalent to the release of a photon and is used to obtain the spectrum of the hydrogen atom.

Energy levels of the hydrogen atom are discrete and this may explain the emission spectrum of the hydrogen atom.

The solution of the Schrödinger equation gives the same values of energy levels as the simple theory of Bohr.

In Figure 7 we can see the final image of Vee diagram:

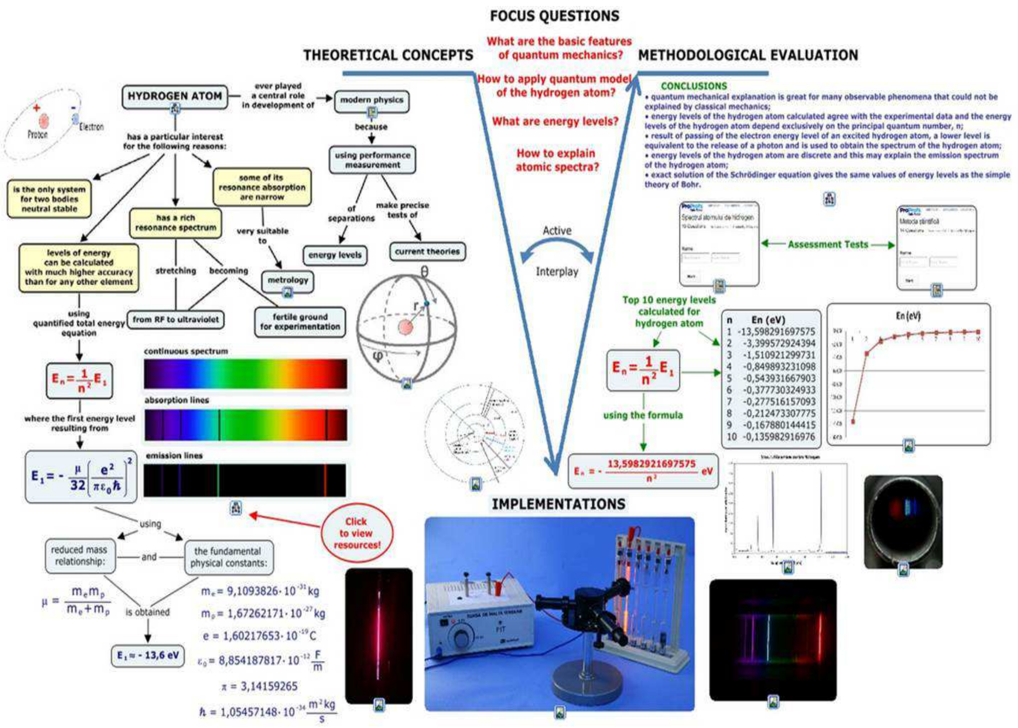

Figure 7. Vee diagram for Spectrum of the hydrogen atom – What are the basic features of quantum mechanics as applied to the hydrogen atom in order to obtain energy levels and atomic spectrum? (http://cmaps.cmappers.net/rid=1M1RRXJGH-RTZF4H-30CV/Vee_Spectrum%20of%20the%20hydrogen%20atom.cmap)

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IHMC CmapTools v5.05.01, Publisher: Florida Institute for Human and Machine Cognition, Installed On: Monday, November 26, 2012, 5:09:48 PM

Study Ohm's Low using Different Types of Experiments

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Abstract

Physics is one of the sciences connected with many practical applications from real life. An innovative way to teach physics is to use computer-assisted experiments in order to enhance students' comprehension of physical phenomena. In this paper, traditional teaching and computer assisted teaching physics were compared to learn the basic laws of electricity. "Ohm's Law", which is an important law in physics and in other fields, was chosen as an example. To teach this law an interactive simulation, a real laboratory experiment and a computer-aided experiment were used. The study also shows how the students are engaging during the experiment, and what the advantages and the disadvantages of each type of experiment are. In order to conduct experiments we have used modern teaching tools such as: computer educational software, interactive whiteboard and an experimental setup COBRA equipped with data acquisition sensors and processing software. For the interactive simulations we have used some from the Phet Colorado Project, which are available for free download. Using these multidisciplinary work conceptions the teachers could make physical activity lessons interactive and could motivate students to learn Physics laws better. Our research's second objective was to also determine the students' interest for the new teaching technologies. In order to achieve this objective, a questionnaire was drawn up for the students. Analyzing the answers we could see that the new teaching methods could facilitate the understanding of Physics concepts and could help students to apply Physics knowledge.

Keywords: *Interactive simulation, Real laboratory experiment, Computer-aided experiment*

1. Introduction

Physics is the discipline closest to real life, offering the possibility of scientific studies of the processes in the surrounding world. Teaching must not be based only on relaying information, but also on developing students' creative thinking which is necessary for a real contact with the surrounding world (Kapita, 1981). The lab experiment contributes to the development of this creative thinking. During the experiment the student observes phenomena, tests hypotheses and applies their result in real life (Chiaverina and Vollmer, 2005). Using new technology in physics allows us to go from memorising information to understanding and appreciating it (Wieman and Perkins, 2005). This subject will no longer be considered a difficult one with a huge quantity of information but it will be directly connected to real life (Wieman and Perkins, 2005). The following study proposes to illustrate the way in which one can verify an important law, not only in physics but also in other domains, respectively the Law of Ohm, using an interactive simulation, a real experiment and a computer-assisted experiment and especially the way the student participates in each type of experiment.

2. The theoretical framework

2.1. Cognitivism and learning

For a lesson to be efficient, the teacher must carefully organise it, in accordance with the chosen cause and in accordance with the cognitive principles concerning how people learn (Wieman and Perkins, 2005). Cognitive research shows that the volume of new information presented during class is far greater than a person can process. The human brain has a very limited working memory. It is limited not only as duration but also as volume as far as the assimilation of new information is concerned. Any cognitive load will limit one's ability to learn new information (Wieman and Perkins, 2005). For the adepts of cognitivism, learning means integrating new information in long-term memory, the capacity of which is limitless (Crahay, 2009). From a cognitivist perspective, the purpose of previous knowledge is very important. The student must not only have this previous knowledge, necessary for integrating new information, but he must also try to use this knowledge during learning (Crahay, 2009). During an experiment, the student builds his own understanding of scientific ideas within the limits of the knowledge he owns (Oral, Bozkurt and Guzel, 2009).

2.2. Types of experiment:

Real experiment;
Interactive simulation;
Computer-assisted experiment.

2.2.1 The real experiment

The real experiment is an optimal way of making the teaching-learning process more efficient. The real experiment must contribute to the development of students' practical abilities, must familiarise the students with handling some precision instruments and must accustom him with technical language, thus realising a greater practical approach to education (Stoenescu and Florian, 2009). Real experiments facilitate the development of students' instrumental and creative intellectual abilities and strategies (Malinovschi, 2001). The Physics experiment educates abstract, analytical and synthetic thinking and creates abilities of understanding the surrounding world (http://www.prointelect.com/node/24). However, a real experiment also has a series of inconveniences, such as:

- ✓ the insufficient number of classes allotted to lab experiments;
- ✓ the insufficient equipment in the Physics lab;
- ✓ the high cost of advanced equipment;
- ✓ preparing lab work takes a lot of time, first of all for checking the equipment and second of all for setting up student groups for each piece of equipment;
- ✓ the time allotted to the data analysis is considerable. Data analysis can be sped up by means of a computer.

2.2.2 Interactive simulations

The method of interactive simulations consists of developing and applying models which represent real natural phenomena (Bulla and Holec, 2004).

The computer cannot replace the physical lab, but it can increase the understanding of the real world (Wiesner and Lan, 2004). Interactive simulations can provide the student with the opportunity to explore what cannot be realised in a real experiment (Smith, Gnesdilow and Puntambekar, 2010). Interactive simulations are less time-consuming than real investigations, thus offering students more time to reflect (Hofstein & Lunetta, 2004). Interactive simulations allow students to control the entry data and to immediately receive feed-back about the result of the changes happening in the experiment (McKagan et al., 2009). Interactive simulations offer an animated, interactive environment connected to the everyday world which serves to not only involve students, but also to support their learning (Adams et al., 2008). The measurements and calculations that students must realise during an interactive simulation give the application a practical feel. In the case of an interactive simulation, students do not need much guidance from the teacher. The interactive simulations are efficient if the Physics lab is equipped with computers. Studies show that students who realise an interactive simulation have a better understanding of concepts and can manipulate equipment more easily in a real experiment (Baser and Durmus, 2010).

2.2.3 Computer-assisted experiment

Computer-assisted experiments are an important part of modern teaching strategies. Computer-assisted experiments must consist of a sensor, an interface and a computer connected to each other (Bulla and Holec, 2004). A powerful system of collecting, analysing and exposing the experimental data is created. One of the most important advantages of such an experiment is displaying the results in real time, as well as the information tables and graphs. Students have the possibility to examine the consequences of a great number of changes in the conditions of the experiment during a short period of time. Students can focus more on the observed phenomenon because they do not have to spend time acquiring and analysing the data (Bernhard, 1997). The consequences of the changes happening during the experiment can be followed in a short period of time (Molefe, Lemmer and Smit, 2005). These experiments present some inconveniences such as the high cost of equipment necessary for the experiment and the fact that students can be passive spectators during the experiment (Saavedra et al., 2008).

3. The method

Our college's physics laboratories are gifted with the most modern didactic means, like PCs, interactive whiteboard, and also equipments for computer assisted experiments, thanks to a donation by the Timken Foundation (Ohio, USA). In this paper, we proposed to highlight the way in which the students get involved during an interactive simulation, a real experiment and during a computer assisted experiment. The study proposes to highlight the advantages and disadvantages, as they are perceived by the students, of each type of experiment. Firstly, an interactive simulation was conducted, using interactive simulations from the Phet Colorado Project, available for free download (http://phet.colorado.edu/en/simulation/ohms-law). A constant value of resistance was set and the current-voltage characteristic was drawn, varying the voltage at the resistor. Data processing programs (SciDAVis) were used for drawing the graphs (http://scidavis.sourceforge.net/download.html). Figure 1 represents an image from the development of this interactive simulation and the figure 2 show .the current-voltage characteristic (interactive simulation) using an electric resistance of 350 Ω.

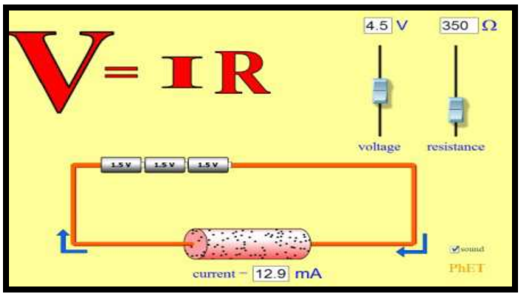

Figure 1. Interactive simulation Ohm's Law (http://phet.colorado.edu/en/simulation/ohms-law)

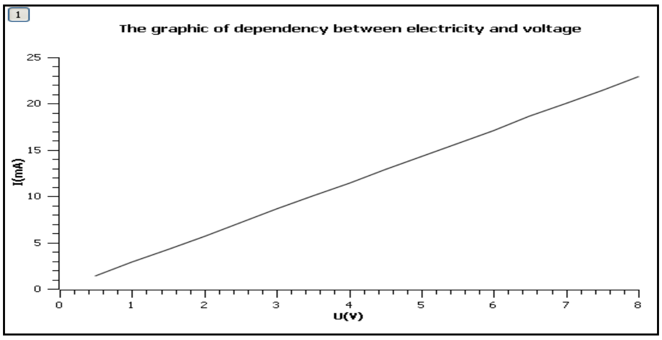

Figure 2. Electric current voltage dependence

After realizing the interactive experiment, students have realized a real experiment for checking Ohm's Law. Figure 3 shows the Ohm's Law equipment and figure 4 shows the current-voltage characteristic (real experiment) using an electric resistance of 47Ω.

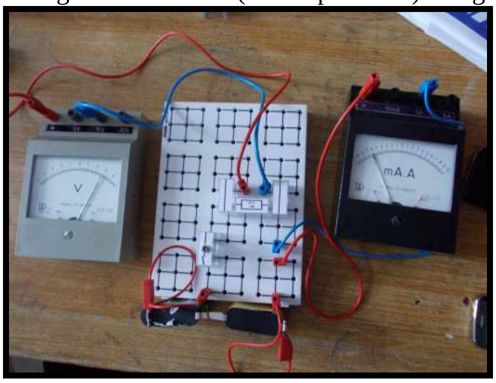

Figure 3. Ohm's Law equipment

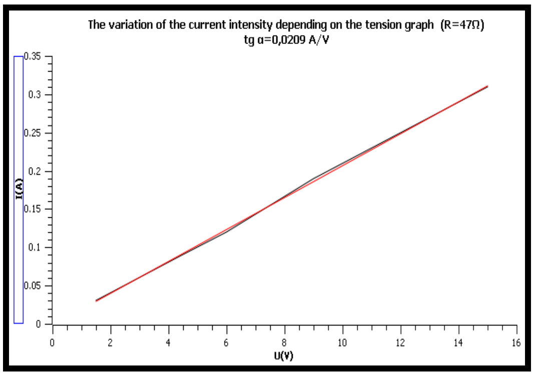

Figure 4. Electric current voltage dependence

Using the slope, the students determined the resistance which was used. Students have participated at a computer-assisted experiment.

Figure 5 shows Ohm's Law experimental setup COBRA 3 of Phywe System GMBH & Co.KG (Germany) and figure 6 shows the electric current voltage dependence, visualised on the interactive whiteboard.

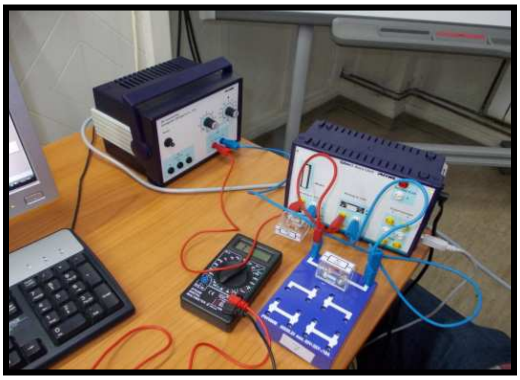

Figure 5. Ohm's Law experimental setup COBRA 3

Figure 6. Electric current voltage dependence

Students were asked to enumerate the advantages and disadvantages for each type of experiment in a questionnaire.

As advantages of real experiment, the students enumerated: getting familiar to the measuring instruments; understanding the notions in a shorter time; developing practical abilities; students' higher involvement; the possibility to ask questions during the experiment.

As disadvantages, the majority of students mentioned the too-high duration allocated for the preparation of the experiment and also the risk of getting injured.

The advantages of an interactive simulation: overall understanding of the phenomenon; avoiding errors; less development time; can be experimentally realized any time it is necessary, without the consumption of any materials; a simulation of a difficult process can be realised; a simulation at home can be realized; it is a nice way to learn physics; the simulations give information about physical results; it offers a nice manner of presenting physical processes; achieving faster calculations.

The disadvantages of an interactive simulation:

- ✓ the students are not as involved as they are in the real experiment;
- ✓ the diminishing of the attention paid to the experiment because the errors are almost inexistent;
- ✓ it does not develop practical abilities;
- ✓ possible misunderstanding of the experiment;
- ✓ it is not as exciting as the real experiment;
- ✓ a possible bad connection to the internet;
- ✓ losing sight of the utility of the measuring tools.

The advantages of a computer assisted experiment:

- ✓ higher concentration on the phenomenon and their effects rather than on mathematical calculations;
- ✓ less duration of development (real experiment);
- ✓ accurate calculations ;
- ✓ a good understanding of the phenomenon;
- ✓ provides a safe working environment;
- ✓ The disadvantages of the computer assisted experiment:
- ✓ it is not easily achieved;
- ✓ lack of direct interaction with the materials;
- ✓ it is expensive.

4. Conclusions

Using modern technology in Physics classes betters the educational act. We demonstrate that students manage to realize a real experiment more easily if they first realize an interactive simulation. Moreover, the computer-assisted experiment allows them to concentrate more on the phenomenon in study, to draw graphs using the data gathered during the experiment and to compare them with the data visualized in real time on the interactive whiteboard. The experiment has the power to motivate students and get them more involved in the instructional process.

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Modern methods of introducing basic Physics concepts

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Abstract

The purpose of this paper is to point out an interactive method to introduce basic physics concepts to youngest students. I will emphasize the way one can use modern methods such as GPS localization, educational software and geographic maps, in order to lure students into developing experimental skills. I will focus upon the advantages of this kind of approach. Studying physics in such an interdisciplinary and interactive way could be at the same time funny but nonetheless rigorous!

Keywords: GSP, Educational software, Modern teaching-learning process

1. Introduction

In order to transform the very young student in an active person which, guided by teachers, discovers and scrutinizes new knowledge territories, there are new teaching strategies in agreement with student's learning manners:

• the lesson should embrace questions and activities that involve the student;

• as part of the lesson, one uses a combination of activities which tackle different learning manners that the student prefers: visual, auditory, practical;

• the lesson involves an active participation of the student in the learning process, through accomplishing experiments, simulations and problems by means of a computer, even when the students start to study/discover Physics.

In education the increase in efficiency is determined by the development of permanent learning competences and of students' and teachers' creative skills (AAAS, 1998).

According to Ausubel, "the most important single factor influencing learning is what the learner already knows".

Thus, meaningful learning results when a person consciously and explicitly ties new knowledge to relevant concepts they already possess. Ausubel suggests that when meaningful learning occurs, it produces a series of changes within our entire cognitive structure, modifying existing concepts and forming new linkages between concepts. This is why meaningful learning is lasting and powerful whereas rote learning is easily forgotten and not easily applied in new learning or problem solving situations which the present science curricula so advocate (Ausubel, 1968).

So, taking into account that the 6-graders are at the very beginning of their Physics study, these "anchors" should be secured into the foundations they got from the study of other subjects. The scientific content must be embedded in a variety of curriculum patterns that are developmentally appropriate, interesting and relevant to the student's lives. The program of science study should connect to other school subjects. The curriculum must put more emphasis on connecting science to other subjects, such mathematics, chemistry, biology, geography, and less emphasis on treating science as a subject isolated from other school subjects.

Use of computers and ICT software tools in classrooms and laboratories provide much more effective and efficient environments in teaching and learning, making physics a science easier to understand. The advantages of using simulation software in conjunction with classroom teaching are well known. It is generally accepted that the use of interactive teaching tools, which provide instant feedback to the student's inputs, improve and accelerate the learning process. The use of simulations and ICT tools in secondary education is not a new concept (Wilkinson & J. Patterson, 1983).

In order to lead the young aspiring scientist's mind toward complex experiments, solid fundaments must be laid down from the very beginning.

2. Target:

Student from grades 6 and 7

3. Objectives

The main objectives of this project are:

- supporting students hands-on learning of science;
- delivering hands-on activity resources to educators;
- learning more about Physics in an unconventional way;
- pointing out anchor-knowledge necessary in teaching new concepts, and training the students in the area of conceptual and operational structures constructions;
- integrating the achieved knowledge and intellectual strategies into a derived general scientific frame;
- uncovering areas of special need that may be difficult to identify without special assessment;
- inspiring the next generation of engineers and scientists;
- integration of the achieved knowledge and intellectual strategies into a derived general scientific frame.

Students will:

- practice using maps;
- understand the underlying principle responsible for the working of the GPS;
- use a GPS unit and understand latitude and longitude coordinates;
- understand the importance of avoiding measurements errors;
- understand the importance of adopting adequate units;
- use mathematical calculations to solve practical problems;
- be able to use a GPS unit to conduct scientific inquiry and demonstrate that changes in motion can be measured and graphically represented;
- be able to distinguish between scalar and vector quantities, between displacement and distance, between velocity and speed.

4. Activities

The structure of the lesson will consist of three modules, each representing an important activity, which the teacher can assemble at its own will or skip altogether. Students getting acquainted with the underlying principle responsible for the working of the GPS

It will be done by means of 2D and 3D animations made by the students (under the supervision of a teacher). Some basic concepts regarding measurement and orientation, such us maps, units, measurement errors and coordinates, will be introduced.

2. Educational game software: reading maps and making use of adequate units, the students will find on the maps certain given locations, acting similar to the working of the GPS. They will

have to solve riddles, use mathematical hints, transformations of units and changes of coordinates, which will all point toward those locations.

3. A hands-on activity that will involve arbitrary measuring units in order to find a number of "treasures". The class will be split into two teams, and the students will be presented with their tasks. They will have to use the inner working of the GPS and to do simple calculations (Pythagoras' Theorem, units' transformations) and the teams will compete to discover the treasures as fast as possible in order to win the game. Each team will receive a working sheet with specific details. (Stoica et al, 2010).

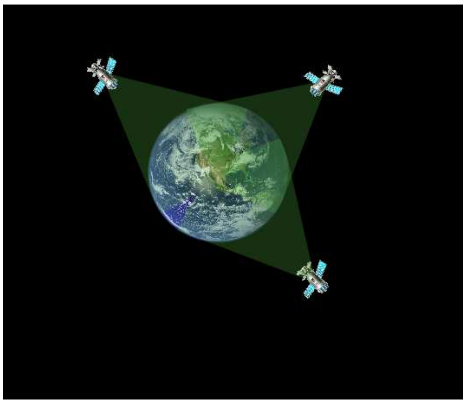

Figure 1. Screenshot from the GPS Educational Software

5. **Assessment**

The students will be assessed on the basis of the working sheets given at activity number 2 and of the educational software for the same activity. Each discovered place will be one mark. The students will receive grades proportional to the number of places/marks discovered with the help of the game. Supplementary, all the students from the winning team will be rewarded with maximum grades.

6. Advantages

The traditional teaching methodology used in secondary education is based mainly on oral speech and use of the blackboard. But it is important to generate understanding using situated examples, visualizations, and dialogues. By using situated examples, the teacher should make the students able to understand the software problem. The principles of the software are then explained through visualizations. Finally, the teacher gives the right sequence of software instructions showing the main implementation steps of the problem solving process (Luehrmann, 1994).

On the other hand the students can use software principles to construct solutions to the problem through involvement in realistic task-based activities. The goal is for the students to construct their knowledge and to work at their own pace from their prerequisites. The teacher works as a mentor and guide of learning rather than as a transmitter of knowledge.

Another advantage offered by this type of lessons is that it includes stimulation of the creativity and of the competition spirit, unconventional tests allowing for an optimal feedback, user-friendly working environments, individual and/or team work visual support, which all offer rapid understanding of even the most subtle and complex scientific themes. By means of an educational game, this lesson allows for a more intense involvement of each student into the learning process: the student will learn by playing in a rigorous mathematical way, because mathematics, creativity, logic, and originality are all needed to improve technology (Stoica, 2004).

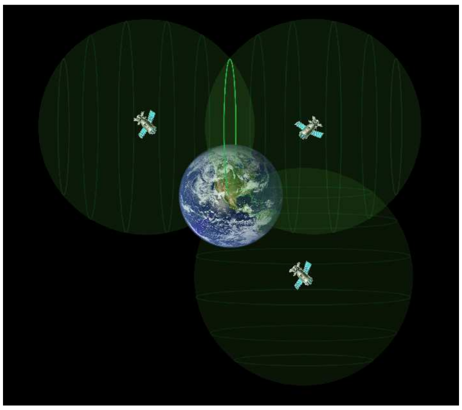

Figure 2. Screenshots from the Educational Software game

Using a cross-curricular approach, the students can get an encompassing view not only over Physics, but also over different another fields (mathematics, geography, computer science). The students will get to know the practical side of Physics and the way information from Physics can be used in other areas. They will study some basic and more complex directional skills so they can navigate nature and the greater biosphere.

Through these lessons, students can access information in real time using GSP software, and can even get in contact with other students who work in the same environment. In this way they will develop working skills both individually and in team, as well as communication abilities and a competitive spirit.

The assessment is an unconventional one, allowing for an optimal feedback.

The teacher who can choose certain lesson stages which are in accordance with topics from the school curriculum, but he/she can also create sequences based on the feedback received from a certain group of students, or on the strategies that he/she uses.

7. Conclusion

The teaching-learning-assessing process needs a student-teacher team, as well as needed to be active. Each didactic activity should be authentic, specific and oriented towards applications that will attract the student. (www.elearning.ro).

I strongly believe that the usage of modern technologies, such as GPS, and of educational software is a must for the educational process, an addition to the classical methods, appealing to the individual character of each student.

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Acceptance of New Learning and Teaching Methods by Students

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Abstract

With the utilization of new teaching and learning methods new forms of learning emerged. In Faculty "Technics and Technology" – Yambol, Trakia University – St. Zagora, VLE has been created and applied, using Moodle platform. The opinion of students from extramural training program has been investigated about quality of education based on the new applied methods of teaching. Students positively accepted new technics and tools of teaching and study without effect of their own skills of working with computers and new technology.

Key words: Web-based learning, e-learning, quality of education, e-learning technology

1. Introduction

Educational technology, especially computer-related, have grown enormously and have permeated in all areas of our lives. The Internet turn into an increasingly vital tool nowadays, more users are going online to implement day-to-day activities, for instance: education, business transactions, personal correspondence, information-gathering, and job searches. Each year, being digitally connected becomes more critical to economic and educational advancement and community participation (Valdez, 2005). If education is about knowledge and intellectual skills, then information technology lies at the heart of it all (John, 2007).

Using technology in teaching is always a trade-off between the time and effort spent creating and maintaining it, and the educational gains achieved by using it (Technology and Teaching, 2013). Knowledge is distinguished from data and information. Data represent observations not directly meaningful. Information is data within meaningful context. Knowledge can be denoted both as a thing to be stored and manipulated and as a process of simultaneously knowing and acting (Blackler, 1995). Knowledge is that which we come to believe and value based on the meaningfully organized accumulation of information through experience, communication or inference (Bobrow&Collins, 1975; Dretske, 1981). A key to successful use of technology is identifying course learning objectives and seeking technologies that can help support those objectives, by focusing on the content instead of the technology (Technology and Teaching, 2013).

Maintaining a feel for how students view and use technology may help inform an instructor's approach to technology in order to support his or her teaching (Technology and Teaching, 2013). In order to evaluate the acceptance of e-learning technology applied in e-learning constructed course of General Chemistry by students an experiment has been carrying out.

2. Material and Methods

In the Faculty of Techniques and Technology of Yambol, e-learning system based on Moodle worked. As a result of different project works the foundations of a data base took place (http://tk.uni-sz.bg/edutk/): lectures, self-assessment exercises, multimedia sources, questionnaires, glossaries, links to other web-based on-line resources etc., has been created.

Data were collected through an anonymous survey from students during the fall semester of 2011. A survey instrument was developed, using five-point Likert-type scale of potential responses: *strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).*

The students were informed that all collected information will be in used for the purpose of investigation. The exposure to e-learning technologies of the participating students varied from 1 to 3 years. All students participated voluntarily in the study. Respondents for this study consisted of 78 (55 females and 23 males). The students involved in this study have been used the technology for all aspects of the course. The course selected for the study was blended learning in field of General Chemistry.

3. Results and discussion

A survey was conducted to investigate student's opinions about blended learning in field of General Chemistry and how that related to the students' abilities of working with computers. We examined the results from two qualitative questions:

Question 1. How many years you work with computer and do you feel well prepared to work with computer technology?

a) Less than 2 years (Neutral);
b) From 2-5 years (Agree);
c) More than 5 years (Strongly agree).

Question 2. Do you think that teaching with the used of new interactive tools causes' better understanding and the lessons are assimilated more easily? The possible answers to that question were:

a) Strongly disagree;
b) Disagree;
c) Neutral;
d) Agree;
e) Strongly agree.

We construct two hypotheses:

Hypothesis H_0: *Signs are independent.* There is no link between the two indications, time of computer work and the acceptance of e-learning as more easily absorbed and understanding.

Hypothesis H_1: *Signs are not independent.* This means that there is a relationship between the time of computer work and the opinions that knowledge is acquired more easily and better.

On the table 1 are shown the empirical frequencies. On vertical columns are situated the levels of first sign (question 1) and on the horizontal rows are plotted the answers of the second question. We missed level 1 at the both signs, because there were no such cases as answer.

Table 1. Empirical frequencies:

Likert-type scale:	Disagree (2*)	Neutral (3*)	Agree (4*)	Strongly agree (5*)	Total
Less than 2 years (3*)	0	3	0	3	6
From 2 to 5 years (4*)	1	6	3	6	16
More than 5 years (5*)	3	11	14	28	56
Total	4	20	17	37	78

***** Likert-type scale: *strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).*

For our purpose, we will use χ^2 the analysis that allows for the testing of statistical hypotheses about the relationship between qualitative variables, which is precisely our case. On the table 2 are shown the theoretical (expected) frequencies.

Table 2. Theoretical frequencies: Expected Frequencies

Likert-type scale:	***Disagree (2*)***	***Neutral (3*)***	***Agree (4*)***	***Strongly agree (5*)***	**Total**
Less than 2 years (3*)	0.307692	1.53846	1.30769	2.84615	6.00000
From 2 to 5 years (4*)	0.820513	4.10256	3.48718	7.58974	16.00000
More than 5 years (5*)	2.871795	14.35897	12.20513	26.56410	56.00000
Total	4.000000	20.00000	17.00000	37.00000	78.00000

***** Likert-type scale: *strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).*

To test the hypothesis of independence of two attributes will calculate statistics $\chi^2 = 5.46$; the number of degrees of freedom f = (3-1)×(4-1) = 6; the minimum level of significance

$$P\{\chi_6^2 \geq 5.46\} \leq 0.485 \quad (1)$$

From the results shown on the chi-square statistics is that the hypothesis H_0 is not rejected. *Signs are independent.*

Our survey shows that all students accepted e-learning approach that included on-line published materials and training quizzes, as more easily absorbed and understanding without the circumstance of how well they work with computer technology.

There are ten fundamental reasons why implementation of technology is important in education (John, 2007):

1. ***Expansion of time and place*** – on-line materials are more available. Information technology allows learning anywhere, anytime; not just in one particular classroom for forty minutes a day.
2. ***Depth of Understanding*** – Interactive simulations and illustrations can produce a much greater depth of understanding of a concept. Using a projector, the teacher can conduct onscreen investigations and demonstrate concepts far more easily than with just words.
3. ***Learning vs. Teaching*** – Instead of teaching (push), students can be given projects that require them to learn (pull) the necessary material themselves.
4. ***New media for self-expression*** – Using modern technology students can: Make a PowerPoint presentation, record/edit spoken word, do digital photography, make a video, run a class newspaper, make a website, create a blog.
5. ***Collaboration –*** A vital skill in the new digital world is the ability to work collaboratively on projects with others who may not be physically close, using modern computer tools such as the web, email, instant messaging and cell phone.
6. ***Going Global –*** The worldview of the student can be expanded because of the zero cost of communicating with other people around the globe. The Internet permits free video conferencing which permits interaction in real time. Using Google has become the de facto method for student research.
7. ***Individual pacing and sequence –*** Information technologies can permit to break step with the class and go at a pace and order that suits that student better. Without disrupting the class, they can repeat difficult lessons and explore what they find interesting.
8. ***Weight –*** A laptop computer weighs about 5lb and provides access to infinitely more material via its own storage and the Internet. A 40 GB hard drive can hold 2 million pages with illustrations; the web is unfathomably large.

9. ***Personal Productivity –*** A student's life is not much different from any knowledge worker, and they need similar tools. Even if they are never used in the classroom, portable personal computers will make a student's (and teacher's) life more effective.
10. ***Lower Cost –*** Through the use of open, free educational tools on the web, the dependence on expensive paper textbooks can be reduced. Developing a web site with links to relevant web sites and/or pages of text and graphics may seem worthwhile at first glance, but prove counter-productive if printing numerous pages requires too much of a student's time or money when compared with purchasing print copies (Technology and Teaching, 2013).

Good teaching is defined as instruction that leads to effective learning. Instructors who wish to improve teaching in a course should consult the literature, see which instructional methods have been shown to work, and implement those with which they feel most comfortable (Richard& Rebecca, 1999). In order to obtain the idea how students evaluated the improving of teaching quality in blended learning program of General Chemistry through applying a new technology tools, we examine the link between introductions of new technical tools in teaching and how students evaluated the improving of teaching quality. The both questions are qualitative:

Question 3. Do you have a positive attitude to the outline of e-learning materials in the learning process?

a) Completely negative;
b) Negative;
c) Neutral;
d) Positive;
e) Completely positive.

Question 4. Do you think that the introduction of new technical tools in teaching improves the quality of teaching and the acquired knowledge's?

a) Strongly disagree;
b) Disagree;
c) Neutral;
d) Agree;
e) Strongly agree.

Then bet null hypothesis denoted by H_0: *Signs are independent*. No relationship between positive attitude in introducing e-materials and systems for e-learning, and whether you believe that the introduction of new technical tools in teaching improves the quality of teaching and learning. We bet and alternative hypothesis in case you do not fulfill the hypothesis H_0, H_1: *Signs are not independent*. This means that there is a relationship between the above-mentioned attributes. Again we will use χ^2 analysis.

Table 3 shows the empirical frequencies. The levels of the first attribute (question 1) are plotted on the vertical (columns) and the levels of a second attribute (question 2) are plotted on horizontal row. The missing levels denoted that there were no such answers.

Table 3. Empirical frequencies:

Likert-type scale:	**Neutral (3*)**	**Agree (4*)**	**Strongly agree (5*)**	**Total**
Completely negative (1*)	1	0	0	1
Negative (2*)	2	1	0	3
Neutral (3*)	10	2	0	12
Agree (4*)	1	10	4	15
Completely positive (5*)	0	5	42	47
Total	14	18	46	78

** Likert-type scale: strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).*

On the table 4 are shown the theoretical (expected) frequencies.

Table 4. Theoretical frequencies: Expected Frequencies

Likert-type scale:	Neutral (3*)	Agree (4*)	Strongly agree (5*)	Total
Completely negative (1*)	0.17949	0.23077	0.58974	1.00000
Negative (2*)	0.53846	0.69231	1.76923	3.00000
Neutral (3*)	2.15385	2.76923	7.07692	12.00000
Agree (4*)	2.69231	3.46154	8.84615	15.00000
Completely positive (5*)	8.43590	10.84615	27.71795	47.00000
Total	14.00000	18.00000	46.00000	78.00000

* Likert-type scale: strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).

To test the hypothesis of independence of two attributes will calculate $\chi^2 = 81{,}33$ statistics; the number of degrees of freedom f = (3-1)×(5-1) = 8; the minimum level of significance

$$P\{\chi_8^2 \geq 81{,}33\} \leq 0.000000 \qquad (2);$$

This means that independent evidence likely to get the same value as in the experience or greater is zero; we will reject the null hypothesis H_0 and accept the alternative hypothesis H_1: *Signs are not independent*. There is a connection between attitudes in introducing e-materials and systems for e-learning, and whether is accepted that the introduction of new technical tools in teaching improves the quality of teaching and causes better deep understanding and learning.

Taking into account the varied learning styles of learners and providing opportunities for self-directed and collaborative learning, educators can facilitate powerful, effective courses geared to achieve specific learning goals and outcomes using the vast resources and capacities of online learning (Instructional Strategies for Online Courses, 2011). Even if an instructor is quite reluctant to adopt something new, there are instances where instructors are well-advised to engage with technology on a minimal level. The content and learning goals inform the selection of the technology tool, and the tool itself open up new teaching and learning possibilities. An instructor should only introduce and use those technologies they are comfortable with (Technology and Teaching, 2013). As documented by the U.S. Department of Education‘s Staying the Course report, online courses and educational programs produce, on average, stronger student-learning outcomes than do those conducted solely in traditional classroom environments (Rickard, 2013). A visual illustration can replaced a thousand words; students can make connections between the various models of learning and in turn provide them with deeper learning understanding. The challenge for education is to design learning environments to be more centered on student learning and for them to reach a deeper level of understanding (Hamel, 2012).

Students tend to have fewer responsibilities, less professional demands, and more leisure time to invest in the social networking that can help ease adopting new technologies (Technology and Teaching, 2013). The greatest impact of electronically distributed learning comes that formal training can take place in the field, giving the students the ability to directly apply or integrate the training materials with their own day-to-day problems. Hence, those materials become more relevant and interwoven into the student’s tacit experience and the learning more meaningful and lasting (Zack, 1999).

4. Conclusion

The fact that many technology options exist should not be viewed as a mandate to use them. The processes of infusing technology into education begin with a simple step. The content and learning goals inform the selection of the technology tool, and the tool itself open up new teaching and learning possibilities. Most importantly is the chosen technology to be accessible to the students and function coherently together (Technology and Teaching, 2013). Our results show that the established e-learning site and database in the Faculty of Techniques and Technology of Yambol, University of St. Zagora, and attached e-learning system based on Moodle as a design VLE, is working and well adopted by students.

All students accepted learning approach that included on-line published lectures and training quizzes, as more attractive, easily engrossed and well understanding, without the circumstance of their skill level in computer technology. Students positively assumed new technics and tools of teaching and study. There is a connection between positive attitudes in introducing e-materials and systems of e-learning, and effectiveness and quality of teaching and learning. The results confirmed that chosen approaches for presentation of investigated e-learning course of General Chemistry is well constructed and fulfill the purpose. The results presented in this manuscript can help institutions in assessment and developing of their e-leaning strategy plans.

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Design and Development of Efficient E-learning Courses

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Abstract

The following article presents the stages of the designing and development of e-learning courses and their content. The factors, influencing the efficiency of the e-learning courses in the process of their development, are also shown. The good practices in the developmental process for efficient e-courses are presented, and are supported with examples driven form the authors's own experience. Keyword: e-learning, design course, development course, efficient e-course.

Key words: e-learning, e-courses, design of e-courses, efficient e-course.

1. Introduction

The new technologies in the education play a bigger and more important role in the education system in the today's culture and help form the transition into an educated society. Both e-learning and distance learning stand out among these new technologies in the educational system, as they require the use of the newest information and communication technologies for their successful implementation. Internet gives one unlimited access to any kind of information, but there is a big difference between receiving information and gaining knowledge.

The aim of the e-course is to present the information in the best possible way, taking into account few factors, in order for the students to gain the necessary knowledge and abilities. The available information in an e-course does not automatically turn into knowledge without the presence of an effective e-course and the help of a lecturer, who can play a different role in the different courses.

2. Design of e-learning courses

E-learning is a standard term, used to describe the different forms of learning, in which the students and the lecturers and separated from each other, both in time and space, and communicate with each other using the available information technologies and devices. The main power behind the improvement in the e-learning is the successful internet and multimedia technologies development. That is why they are presented as some of the main characteristics, and are specified in the definition of e-learning, proposed by other authors.

According to Clark and Mayer (2008) e-learning is any instruction that is delivered on a computer which has the following characteristics:

- Includes content relevant to the learning feature.;
- Uses instructional methods such as examples or practice exercises to help learning.;
- Uses a variety of media elements to deliver the content and methods.;
- Builds new knowledge and skills which are linked to improved organizational
- performance.

Thus, the goal of e-learning is to build transferable skills and abilities.

E-learning can be defined as instruction delivered via a computer that is intended to promote teach (Clark&Mayer, 2008). This definition can be broken down into the what, how, and why of e-learning:

What. Instruction refers to content (e.g., words and pictures describing how lightning storms develop) and instructional methods (e.g., presenting words in spoken form rather than printed form). E-learning depends on instructional material being presented using effective instructional methods.

How. Delivered via a computerrefers to presenting material via a computer by way of internet, intranet, CDROM, or related means. Instructional output includes images and printed words that appear on a screen, and sounds and spoken words from a speaker or headphones; learner input includes spoken words through a microphone, characters entered on a keyboard, and screen items clicked with a mouse. Thus, e-learning uses the output and input channels of computers and their peripheral devices.

Why. Intended to promote learning refers to the goal of helping to foster changes in learners' knowledge, which is reflected in changes in their performance. Thus, e-learning is intended to help people achieve learning objectives.

The following definitions better capture the essence of e-Learning:

- E-Learning is a vibrant, dynamic, and exciting way to learn new skills and concepts.;
- E-Learning is all about learners – capturing their attention with content specifically.;
- Designed to meet their immediate needs in a self-paced and comfortable environment.]
- E-Learning is interactive, holding learners' attention by involving them in the learning process every step of the way.;
- E-Learning allows learners to learn by doing, by being involved, by receiving immediate feedback, and by allowing them to monitor their progress with quizzes, tests, and handson activities.;
- E-Learning uses learners' senses – appealing to their auditory, visual, and tactile senses.

The designing of e-courses should begin with the determining of the *educational goals* – knowledge, abilities and habits, by taking into account the additional opportunities provided by the technologies that are used in the e-course design and development. When the educational goals are determined, one starts formulating the *course content*. The learning material should be presented as modules and themes. The appropriated educational method is selected, and the modules and work scenarios are designed. The design, that has to turn the methodological ideas into an interface, is being decided at the technological stage of the development. At this stage every course is looked at as an individual entity and no ready-made environment for e-course design is used. The next step is the design and development of the functional structure of the e-course. No matter of the chosen method for design and development, the e-course has to ensure a comprehensive presentation of the specific subject area, has to provide an effective use of the pedagogical and methodological principles, it also has to be an adequate system for knowledge control and sustain a differentiated approach to the organization of the students' independent work on assignments.

3. Efficient of E-learning cources

Traditional classroom learning can be effective or ineffective - depending very much on how it is presented by the teacher. E-Learning is no different – it too can be good or bad, depending on the skills of the designer/developer (Steen, 2008). In order to be ssuccesful one e-course, important role play as the desiner thus the teacher, i.e. those that must to proect and develope together the e-course. The e-training is not effective by itself. From one side, its effectiveness depended from the proper management, instructions and advices given from the teacher during the entire learning process (Ступин&Ступин, 2012). From another side, the main role of teacher confirms from the useless of the e-material developed in professional centers without the active involvement of the teacher that construct the lessons and apply these e-materials.

Organizations have a need for effective training (Steen, 2008). Training designers have to be able to design effective eLearning to meet those needs. This is difficult because designing successful eLearning is part art and part science, involving the use of learning and training theory and an understanding of the knowledge and/or skills to be taught. The design also has to be completed within the constraints involved in all phases of the training design and implementation. Further complicating the process is the diversity of equipment, tools, and techniques involved. A final complication is the fact that there is no one-size-fits-all approach to the design of eLearning. Each course is unique. However, there is a general process whereby the designer balances the elements involved. If the designer does everything correctly, there is a greatly improved chance that the result will be effective eLearning.

To be effective, eLearning must meet certain criteria. As noted by Angeliki, Asimina, and Eleni (2005), in general effective eLearning has the following characteristics:

- *Successful in reaching learning objectives;*
- *Easy accessibility;*
- *Consistent and accurate message;*
- *Easy to use;*
- *Entertaining;*
- *Memorable;*
- *Relevant;*
- *Reduced training costs.*

When start construct e-learning course, first step should be to build a development plan for the following reasons (Steen, 2008):

- A Course Development plan can be shared with all those involved in the project so that individuals know exactly what the expectations are, and what their own role is in the overall process.;
- A well planned process leaves little room for the misunderstanding of objectives.;
- Developing a plan allows for time, resources, and cost management factors to be worked into the big-picture.;
- If management approval needs to be petitioned, a good development plan will permit you to submit a clear and valid proposal.

Successful e-Learning development begins with a well-designed course development plan. While many of the factors of a development plan may vary according to organization size and extent of work, the following stages should always be implemented (fig.1):

- ***Design –*** Design stage will be conducted by one or more Instructional Designers, and maybe a Project Manager. The first stage of the development plan's process should include: *Analysis of content* – breaking it up (mapping) into logical course structure objects; *Creating a Design Document* and/or Storyboard; Creating and distributing *Standards Guidelines*; Creating *Master Pages, Page Templates* and *Course Templates*;
- ***Develop*** – The Development stage of the process would include *Instructional Designers*, *Course Developers*, *Graphic Designers*, and *Reviewers*. Some of the activities involved with this stage may be: - *Content input;- Page layout;- Multi-media development;- Interactive content design and development;- Standards checklists;- Quiz and Test development.*
- ***Review –*** The Review stage should be conducted by Editorial, Instructional Design, and Subject Matter Expert (SME) Reviewers. These roles can often be taken on by one or two people. After content has been reviewed, courses may have to go through a second stage of development, depending on the Review outcomes. Final content approval should come from a lead Instructional Designer.

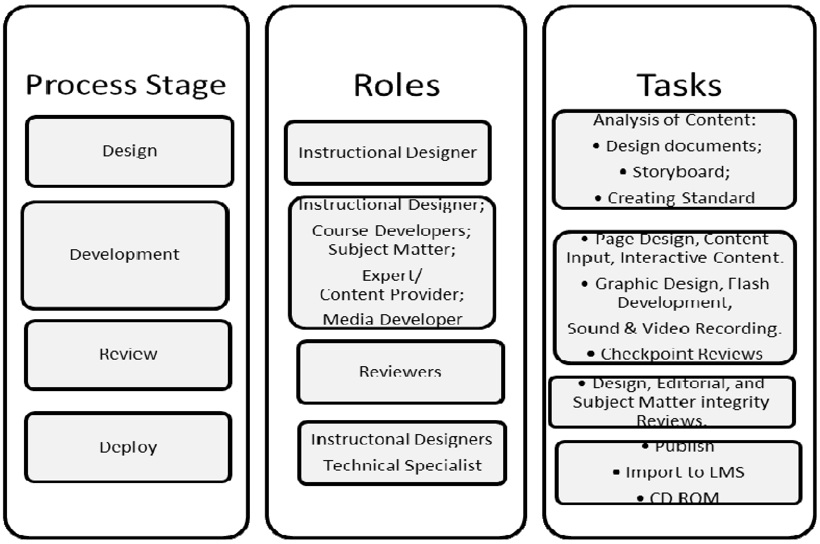

Figure 1 Main stages in development of e-courses

- ***Deploy*** – The Deployment stage involves the packaging and delivery of content to the location at which learners access the course. This may be a CD-ROM, Learning Management System (LMS), an Internet website, or an internal network.

The Figure 2, below shows a typical Pass Cycle (Group), and some of the major tasks involved in each pass.

Pass Major Tasks

Pass 0 Content Analysis; Design Document; Internal project plan; Instructional Design Model; Templates; Mapping; etc.

Pass 1 Mapping; Content Development; Graphics, animations, slideshows design & development.

Pass 2 Design & development of interactions; Design & development of assessments; Initial internal review and editing/QA; Beta testing.

Pass 3 External Review.

Pass 4 Review comment implementations, Revisions.

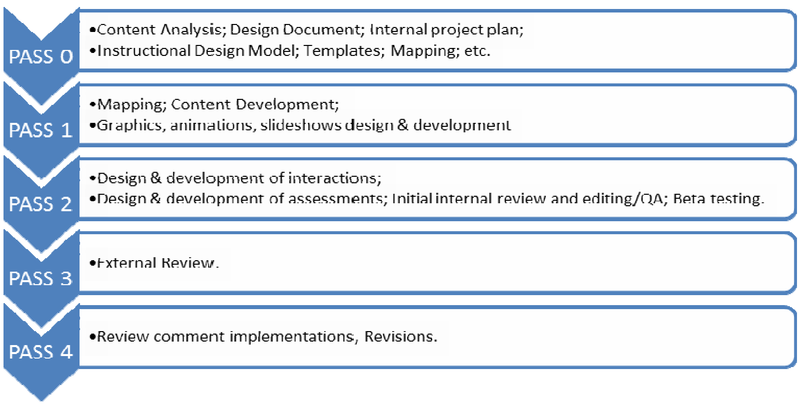

Figure 2 A typical Pass Cycle (Group), and some of the major tasks involved in each pass

Instructional theorist Robert Gagne (2013) developed nine events of instruction that when put together, make up a practical process for effective learning. Most instructional design is based on these events and the process is widely used in teaching practices. These principles of instruction should also apply in any design of e-Learning.

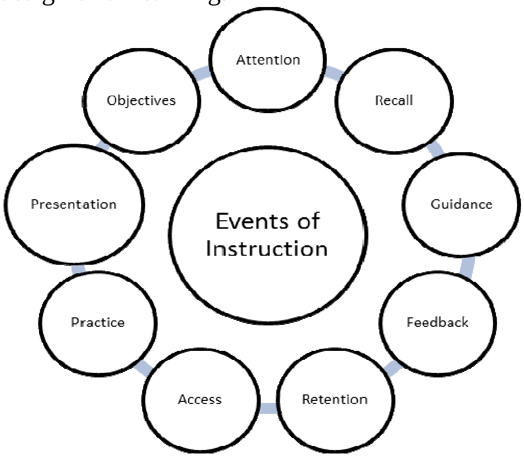

Figure 3. Gagne's Nine Events of Instruction

These best practices address each of the Events of Instruction in a way that will provide guidelines for applying sound instructional principles to e-Learning.

• ***Gaining Attention*** – While using effective means of gaining and holding learners' attention is important throughout a course, it is particularly so at the beginning of a course. "Startling" a learner is a good way of grabbing their attention, and should occur on one of the first pages of a lesson. This can be achieved by using the learner's auditory and/or visual senses, or with a statement that is immediately thought-provoking or relevant to their learning needs. Instructional designers will often use a *Flash presentation* as it can provide all the components mentioned.

• ***Objectives*** - Well constructed and presented learning objectives provide both guidance and motivation. Learning Objectives in e-Learning are no different than for traditional instructor-led training. The most important things to remember are:

- *Learners should be informed of the objectives before the lesson begins. Ideally objectives would accompany the lesson/course outline.;*
- *Learning content presented should provide all the information needed to meet the objectives.;*
- *Assessment questions should be based on and test against the learning objectives.;*
- *With e-Learning, prescriptive learning can be constructed based on the learning objectives.*

• ***Stimulate Recall*** – Stimulating recall of prior learning provides the learner with a sense of personal relevance and stimulates motivation. With e-Learning, this can be achieved in a variety of ways:

- *Providing prerequisites helps to remind the learner of prior learning in the subject matter.;*
- *Pre-tests can test for and stimulate prior knowledge and experience.;*
- *Assumptions of prior knowledge can be made clear in the lesson/course overview.;*
- *Lesson content may contain references and questions to necessitate recall of prior knowledge and experience. With e-Learning, learners can obtain immediate feedback on their recall.*

• ***Presenting Content*** **-** Presentation of content (subject matter) is where traditional Instructor-Led Training (ILT) and e-Learning differ greatly. In the absence of an instructor, e-Learning designers must rely heavily on the content presentation of their lessons. The way in which content is presented in e-learning, and especially with a "*Page-Based*" development application such as Trainer is of prime importance and can "make or break" a course.

• ***Learning Guidance*** **-** Wherever possible, additional guidance should be provided to the learner to facilitate recall. E-Learning is perfect for providing any of the learning guidance strategies, especially anything of an interactive nature. Strategies used for this guidance can include the following: *Examples and Non-examples; Analogies; Simulations; Case Studies; Graphical Representations*.

•***Elicit Performance*** **–** It is important to elicit learner performance by providing the opportunity to practice new skills and confirm understanding. This should happen at the end of each section/topic/lesson, before going on to a new one. E-Learning enables a variety of dynamic, interactive, and "hands-on" practice opportunities, such as: *Interactive Questions; Controlled Simulations; Real on-the-job Activities.*

• ***Feedback*** **-** Providing *formative feedback* to learners within the context of practicing new skills and behaviors is crucial to confirming understanding. This is even more important within e-Learning in the absence of instructor feedback, which is largely dependent on the practice activity involved.

• ***Assessment*** **–**e-Learning should give learners the opportunity to assess their knowledge. It is important to remember the following points: *Test questions must be used to test against the objectives set for the lesson/course. Test results should include remediation to guide the learners in areas where they may need to reinforce or review their knowledge. Tests should provide the learner with their resulting scores. Scoring can trigger the delivery of a certificate for print, if appropriate.*

• ***Enhance Retention*** **-** To enhance a learner's retention so that they may transfer new knowledge and skills to their jobs can be achieved in a variety of ways in e-Learning. For example, repetition of content can be achieved in creative ways, such as simulations/activities that first show the learner, then let them try for themselves. Learners can be provided with "Job Aids" to take away from training. These job aids can be made available to learners by providing opportunities to print or download items such as cheat-sheets, procedure tables, and training guides and materials.

Giving learners further information in the form of textual references, related websites, or further training recommendations can also serve to enhance their retention.

As with any page-based course development application, great attention must be paid to the overall look and feel of every single page of the course. Pages should not be boring, yet they should not be so busy that they confuse the learner. Learners should always be comfortable within a course, yet not so comfortable that their attention wanders. Pages should always present a good balance of vibrancy and instruction.

4. Conclusion

A differentiated approach, taking into account a few factors that influence the courses, is being used in the development of e-courses. The subjective preferences of the students and their requirements are also taken into account. The platform, used for their development, allows the creation of a coherent structure of the learning materials and supports the use of instruments for easier navigation among those learning materials.

The system for blended learning, which is used at the Faculty of Engineering and Technology http://tk.uni-sz.bg/edutk/, is convenient and easy to use. Worthy of mentioning is also the fact that it is an open source platform that is under development at all times and new activities are being added to it, as well as it gives the opportunity to use additional resources. With the latest actualizations and additions it allows for a web conference and a new addition is the possibility to check for plagiarism in the students' work assignments, which are saved in the e-learning system. All new developments and activities in the platform are taken into account in the design and development of e-courses.

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Conditions That Can Advance the Learning Effectiveness

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Abstract

Educators must be prepared for a technology-rich future and keep up with change by adopting effective approaches that permeate lessons with appropriate technologies. Students view teaching with the use of new technics and e-learning materials as more attractive and think that the adequate equipment in computer rooms of dormitories will improve their self-preparation and the efficiency of learning.

Key words: Web-based learning, e-learning, computers, educational technology, quality of education, learning effectiveness

1. Effects of Technology on Learning Effectiveness

The main goal of education is learning. Learning effectiveness must be the first measure by which online education is judged. Indeed, when online learning was first implemented, a majority of educators thought that it could never be as good as face-to-face learning. Many still do. Actually, now have good and sufficient evidence that students generally learn as much online as they do in traditional classroom environments (Swan, 2003). In the period between 1996 to 2008, more than a thousand empirical studies of online learning were exanimated from U.S. Department of Education (2010), that exanimated the problems about:

- *contrasted an online to a face-to-face condition;*
- *measured student learning outcomes;*
- *used a rigorous research design; and*
- *provided adequate information to calculate an effect size*.

Based on the 86 studies and using learning outcome data from over 15,000 participating students, analysis demonstrates that students engaged in distance education academically outperform their face-to-face colleagues (Shachar&Neumann, 2003). Data from over 20,000 participating students, clearly demonstrated that in 70% of the cases, students taking courses by distance education outperformed their student colleagues in the traditionally courses (Shachar M., & Neumann, Y., 2010).

Patrick&Powell found (2009) no significant differences in student performance compare online courses versus traditional face-to-face courses, students learning online are performing equally well or better. In a two-year quasi-experimental study of undergraduate students, more learning as measured by content questions and better performance on examinations among students in the online sections was found (Maki, et al., 2000). Neuhauser (2002), compare two sections of the same course, one section online and asynchronous; the other face-to-face., the two sections were taught by the same instructor and used the same instructional materials. The results revealed no significant differences in test scores, assignments, participation grades, and final grades, although the online group‘s averages were slightly higher. Ninety-six percent of the online students found the course to be either as effective as or more effective to their learning than their typical face-to-face course.

According to Kozma (2003), new information and communications technologies (ICT) can bring exciting curricula based on real-world problems into the classroom, and provide frameworks and tools to enhance learning. Indeed, most educational technologists today agree that instruction should be designed to take advantage of the unique characteristics of media that matter or that can be made to matter in teaching and learning (Swan, 2003). Teachers in many countries are beginning to use ICT to help change classroom teaching and learning, and are integrating technology into the curriculum. Students are working together in teams and using computer tools and resources to search for information, publish results, and create products (Kozma, 2003).

Definitely, studies are needed that directly assess the impact of ICT on student learning (Kozma, 2003). Technology actually assists to make teachers and their students more successful. A student's life is not much different from any knowledge worker, and they need similar tools. Even if they are never used in the classroom, portable personal computers will make a student's life more effective. To cash in this benefit, schools need to go paperless (John Page, 2007).

In the study we try to estimate student's opinion about new technology teaching approaches and the circumstances that they think is important in order to obtain higher grade and gain better knowledge, conditions that can advance learning effectiveness.

2. Material and Methods

In the Faculty of Techniques and Technology of Yambol, e-learning system based on Moodle worked. As a result of different project works the foundations of a data base took place (http://tk.uni-sz.bg/edutk/): virtual library, which included lectures, self-assessment exercises, multimedia sources, questionnaires, glossaries, links to other web-based on-line resources etc., has been created.

Data were collected through an anonymous survey from students during the fall semester of 2011. A survey instrument was developed, using five-point Likert-type scale of potential responses: *strongly disagree (1), disagree (2), neutral (3), agree (4), and strongly agree (5).*

The students were informed that all collected information will be in used for the purpose of investigation. The exposure to e-learning technologies of the participating students varied from 1 to 3 years. All students participated voluntarily in the study. Respondents for this study consisted of 78 (55 females and 23 males). The students involved in this study have been used the technology for all aspects of the course. The course selected for the study were on field of Chemistry and combined both e-learning and traditional learning tools, so-called blended learning.

3. Results and discussion

A survey was conducted to investigate the link between using on-line source of lectures and quizzes, acceptance of applying new technical teaching approaches by students, and how it relate to their experience with computer technology, and learning effectiveness. We examine the answers to two qualitative questions:

Question 1. How well (long) you use Internet?

Question 2. Do you think that introducing new technical tools in process of teaching increased the quality of education and acquired knowledge?

The possible answers were given by Likert classification, mentioned above.

We will attempt to look for a link between qualitative variables by two traits i.e. whether students who are engaged for a longer time with Internet believe that the introduction of new technical tools in teaching improves the quality of teaching and knowledge or between those signs there is no relation. Then will denote hypothesis by H_0: *Signs are independent*. The alternative hypothesis in case does not fulfill the hypothesis H_0, H_1: *Signs are not independent.* This means that there is a relationship between the time of use of the Internet and the view that the introduction of new technical tools in teaching improves the quality of teaching and learning.

Table 1. Empirical frequencies:

Likert-type scale:	***Strongly disagree (1*)***	***Disagree (2*)***	***Neutral (3*)***	***Agree (4*)***	***Strongly agree (5*)***	**Total**
Less than 2 years (3*)	0	1	1	1	3	6
From 2 to 5 years (4*)	1	1	5	2	10	19
More than 5 years (5*)	0	1	5	11	36	53
Total	1	3	11	14	49	78

***** Likert-type scale: *strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).*

For our purpose, we will use the χ^2 analysis that allows for the testing of statistical hypotheses about the relationship between qualitative variables, which is exactly our case.

On the table 1 are shown the empirical frequencies. On the vertical are plotted levels of the first attribute (Question 1) and on the horizontal are plotted levels of a second attribute (Question 2).

On the table 2 are shown the theoretical (expected) frequencies.

Table 2. Theoretical frequencies: Expected Frequencies

Likert-type scale:	***Strongly disagree (1*)***	***Disagree (2*)***	***Neutral (3*)***	***Agree (4*)***	***Strongly agree (5*)***	**Total**
Less than 2 years (3*)	0.076923	0.230769	0.84615	1.07692	3.76923	6.00000
From 2 to 5 years (4*)	0.243590	0.730769	2.67949	3.41026	11.93590	19.00000
More than 5 years (5*)	0.679487	2.038462	7.47436	9.51282	33.29487	53.00000
Total	1.000000	3.000000	11.00000	14.00000	49.00000	78.00000

***** Likert-type scale: *strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).*

In order to test the hypothesis of independence of two attributes will calculate statistics $\chi^2 = 10{,}66$; the number of degrees of freedom f = (3-1)×(5-1) = 8; the minimum level of significance

$$P\{\chi_8^2 \geq 10.66\} \leq 0.22 \quad (1);$$

That means the independence of the attributes, years of working with the Internet and whether the introduction of new technical tools in teaching improves the quality of teaching and learning outcomes, the probability of obtaining value as in experience or more is significantly - 22%. From the results shown on the chi-square statistics is that the hypothesis H_0 is not rejected.

E-learning requires technical complexity from instructors as well as students (Jones, 2003). There are two determinants of *new technology acceptance*: **perceived usefulness** - "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, as cited in Venkatesh et al., 2003), and **perceived ease of use** - "the degree to which a person believes that using a particular system would be free of effort". “Ease of use” is extremely important factor (Sela&Sivan, 2009). Four dimensions may be used to better understand student motivation and attitude towards technology-mediated learning. These factors referred as the dimensions to a computer mediated classroom are (Saadéet al., (2011) :

- ***Affect*** - refers to an individual's feelings of joy, elation, pleasure, depression, distaste, dis-contentment, or hatred with respect to particular behavior (Triandis, 1980). Literature showed a strong relationship between affect and behavior. Positive affect to-wards technology leads to gaining experience, knowledge and self-efficacy regarding technology, and negative affect causes avoiding technology (Arkkelin, 2003).,
- ***Attitudes*** - Marzano and Pickering (1997) indicated that students' attitude will impact the level of learning they achieve.;
- ***Intrinsic motivation*** - intrinsic and extrinsic motivation are key drivers of behavioral intention to use technology (Venkatesh, 1999; Vallerand, 1997).
- ***Extrinsic motivation*** - as the performing of a behavior to achieve a specific reward**.**

Although the frame of literature on beliefs and emotions is large and growing, its subset dealing with students' beliefs towards technology mediated learning is small, it is clear that beliefs and associated evaluations lead to intentions (Saadéet al., 2011).

The survey of study reveals that nowadays students have a good skill in computers and they easy use new technology, they use computer and communications technologies (ICT) with pleasure, so accepted new technical approaches in education as more effective and as tool that enhance teaching quality. The results from the final exams confirmed that students using on-line quizzes as learning tool are performed on the exam well and gain high marks.

There are many factors that affect technology implementation (Means et al., 2001), including the following:

- Lack of technology infrastructure.
- Lack of technical support.
- Teacher discomfort with technology.
- Lack of high-quality digital content.
- Lack of instructional vision for technology use.
- The constraints of academic schedules and departmental structures.
- Lack of student technology skills.
- Low expectation of students.
- Accountability pressures.

An important consideration for institutions is how the effectiveness of e-learning offerings will be assessed. Often measurement is based on return on investment in the technology infrastructure and course content development. This measure is certainly relevant and also vital to consider effectiveness in terms of learning outcomes (Romiszowski, 2004). An e-learning exercise can only be considered effective if learning took place. The tendency of organizations to focus on return on investment can encourage cheaper program development, at the expense of learning effectiveness (Weller, 2004). Depending on the technological infrastructure, the implementation of e-learning courses can involve very costly technology upgrades (Weller, 2004). Often, budgetary restriction is a primary issue for institutions (Huynh et al., 2003). Tight budgets make it difficult to implement broad, campus-wide e-learning solutions (Wagner et al., 2008).

In the conducted survey we also examined the responses of students in connection to their acceptance of e-learning as more attractive teaching tools and what measure is important as circumstances in order to improve their learning.

Question 3. Do you think that teaching with the use of e-materials is more attractive?

Question 4. Do you think that adequate equipment in computer rooms in the dormitories will improve self-training of students and enhance learning effectiveness?

Then null hypothesis will denote by H0: Signs are independent. No connection between teaching using e-materials and that the adequate equipment in computer rooms in the dormitories will improve students' self-preparation and enhance learning effectiveness. The alternative hypothesis in case not fulfills hypothesis H0, H1: Signs are not independent. This means that there is a relationship between the above-mentioned traits.

Table 3 shows the empirical frequencies. The first quality (Question 1) is plotted on the vertical columns and a second attribute (question 2) is plotted on the horizontal rows.

Table 3. Empirical frequencies:

Likert-type scale:	***Strongly disagree (1*)***	***Disagree (2*)***	***Neutral (3*)***	***Agree (4*)***	***Strongly agree (5*)***	**Total**
Completely negative (1*)	0	0	0	1	1	2
Negative (2*)	0	0	0	0	0	0
Neutral (3*)	1	1	15	2	8	27
Agree (4*)	0	1	3	7	4	15
Completely positive (5*)	0	0	3	3	28	34
Total	1	2	21	13	41	78

***** Likert-type scale: *strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).*

On the table 4 are shown the theoretical (expected) frequencies.

In order to test the hypothesis of independence of two attributes will calculate statistics $\chi^2 = 39{,}53$; the number of degrees of freedom f = (4-1)×(5-1) =12; the minimum level of significance

$$P\{\chi_{12}^2 \geq 39.53\} \leq 0.000086 \quad (2);$$

Table 4. Theoretical frequencies: Expected Frequencies

Likert-type scale:	***Strongly disagree (1*)***	***Disagree (2*)***	***Neutral (3*)***	***Agree (4*)***	***Strongly agree (5*)***	**Total**
Completely negative (1*)	0.025641	0.051282	0.53846	0.33333	1.05128	2.00000
Negative (2*)	0	0	0	0	0	0
Neutral (3*)	0.346154	0.692308	7.26923	4.50000	14.19231	27.00000
Agree (4*)	0.192308	0.384615	4.03846	2.50000	7.88462	15.00000
Completely positive (5*)	0.435897	0.871795	9.15385	5.66667	17.87179	34.00000
Total	1.000000	2.000000	21.00000	13.00000	41.00000	78.00000

***** Likert-type scale: *strongly disagree (1) disagree (2), neutral (3), agree (4), and strongly agree (5).*

This means that independent evidence likely to get the same value as in the experience or greater is zero, we will reject the null hypothesis H_0 and accept the alternative hypothesis H_1: *Signs are not independent*. Being able to use technology is no longer enough. Today's students need to be able to use technology to analyze, learn, and explore. ISTE's Digital age skills are vital for preparing students to work, live, and contribute to the social and civic fabric of their communities (ISTE, 2012). The conducted survey shows that students accepting e-learning as attractive approach usually are hard worker to achieve better understanding and high mark so they complain from lack of good conditions in dormitories. Available equipment in computer rooms in dormitories will improve learning and students' self-preparation for exam.

Technology-mediated learning includes both e-learning and computer-assisted learning using any technology (Saadé et al., 2011). There are enormous amount of content available through the World Wide Web, however, information is not learning (Shank, 1998). Indeed, interactions among students have been perceived by many authors as the most unique and interesting sources of learning (Swan et al., 2000; Levin, 1990).

Certain strategies and approaches that might enhance the learning effectiveness of online supported learning have been mentioned from (Shank, 1998):

- *Interactions with course interfaces are a real factor in learning; difficult or negative interactions with interfaces can depress learning* – based on our practice we can support that point of view, if appears errors or difficulties with some applications, students quickly lose interest and their activity decreased;
- *Greater clarity and consistency in course design, organization, goals, and instructor expectations leads to increased learning* – instructor must clearly state the tasks for students, usually students like to cooperate with teachers when they practice on-line. They also like the opportunity to report if some error or misunderstanding appears in the quizzes or application.;
- *Ongoing assessment of student performance linked to immediate feedback & individualized instruction supports learning* – our experience can confirmed that usually students receiving immediately feedback work better and put more efforts to obtained greater score.

E-learning systems oblige several components including course management systems, technology equipped classrooms, and adequate computer facilities for student use (Arabasz&Baker, 2003). Online learning is not a “solution.” It is not a methodology. It is a tool. If we work to improve the functionality of the tool, the conditions in which we make use of the tool, and the ability of the craftsman to use the tool, we may attain the elusive improvements in meaningful teacher quality for a larger number of beneficiaries (Burns, 2012). An administration wishing to improve the quality of its instructional program should first make the necessary commitment to provide the necessary resources (Felder&Brent, 1999).

4. Conclusion

Progressively, ICT is coming to be incorporated into various subjects in the curriculum and across subjects. Today students have good computers skill and use with pleasure new technology, so accepted a new technical approaches in education as more attractive and effective. Students’ views teaching with the use of new technics as more meaningful and with higher quality, and think that the adequate equipment in computer rooms of dormitories will improve self-preparation and effectiveness of learning.

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How Technology Influence Student Attendance and Success

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Abstract

The educational process supported by information and communication technology (ICT) changed the traditional education. Technology is used to create more meaningful and attractive assignments. The report analyzed the influence of available Web-based e-learning materials on students' interest, motivation, lessons attendance and exam success. Power Point presentation technology can engage students by making lectures more interactive and allows lectures to keep track of whether students understand the material.

Key words: Web-based learning, e-learning, lessons attendance, exam success

1. Technology and education

Technology integrate teaching and learning inside and outside the classroom, and improve the way by which the material is presented and comprehension (The Most Effective Training Techniques, 2013). Educators must get ready for a technology-rich future and sustain with change by accepting effective strategies that permeate lessons with appropriate technologies (Valdez, 2005). A key to successful use of technology is recognizing course learning objectives and looking for technologies that can help support those objectives. New media help to teach difficult concepts and motivate students to perform at a high level, but using technology for its own sake can be a frustrating experience (Technology and Teaching, 2013).

Technology impacts so many areas of modern life, which it's impossible to ignore. According to a Pew Project for Excellence in Journalism survey, 65 % of 18- to 29-year-olds rely on the Internet as their main source of news (Elliott, 2013). Internet use is becoming more common, 76 % the household members use the Internet for reading online newspapers or magazines, 74 % for sending and getting e-mail, 69.7 % for sending instant message, 69.7 % for downloading music or listening music (Yukselturk E. 2010). Students learn by cooperating with technology and with their peers. The use of technology in the web 2.0 world reminds us that we are not alone in front of our computer screens; schools can thus profit from this connectedness to enrich the learning environment of their students (Hamel, 2012). Technology provides a cornucopia of tools for learning (Hutinger, 2013).

Even Power Point presentation technology can engage students by making lectures more interactive and allows lectures to keep track of whether students understand the material.

2. Student attendance and blended learning

Blended learning delivers opportunities for participation of students in education, regardless of time or place. To improve the opportunities for participation in education, the education provider must seek new solutions to increase the flexibility of education. That means, first and foremost, enabling new, flexible ways of participation (Hakala&Myllymäki, 2011).

In the new era of global communication, full access to lecture notes and a comprehensive course websites, instructors fear that students will not attend lectures. Some researchers state that 25 % or more students are likely to be absent from lectures on any given day (Friedman et al., 1999).

Research conducted by Schwartz (1997) focused on the influence that the World Wide Web has on student attendance. He noticed that the web has led to less lecture attendance by the students in some courses. However, studies have shown that students use alternate content channels for review and rarely as a substitute for the classroom lecture (Technology and Teaching, 2013). Students are not only accepting the responsibility, but also realising the importance of attending lectures (Jordaan, 2009). However, Lundgren and Nantz (2003) found that students viewed the availability of course material on the web as an adequate excuse not to attend lectures. Nevertheless, absence can be viewed as a very personal decision based on both the ability to attend and the motivation to attend (Kottasz, 2005).

Base on the literature review and our experience, the main factors raising attainment levels are:

a) *Age and genter of students* – students in the Faculty are with age between 18 to 51 years and average around 21-24 years old. Usually younger or older student attend more regularly lectures, but there no difference according to genter. Fritschner (2000) revealed that different age and gender contribute to the level of participation of students in lectures. There is a stronger tendency for females to attend lectures (Jordaan, 2009). ;
b) *Subject of the course* – the results display that more difficult courses have higer range of attendance compare with not so tough subject. Being able to take their own lecture notes, learning which aspects of the lecture content were being emphasized (Bati et al., 2013). The 11 students out of 12 explained that they would only not miss a lecture if the subject area was very difficult and if they did not know peers to copy handouts from (Kottasz, 2005). Although, Wolbring (2012) found that absenteeism is higher, if the course pace is too fast and courses are too difficult. ;
c) *Perceived value of attending lectures* – if students have a perception that they learn much and being present help them to understand the subject, a high level of attendance is observed. Reasons for missing lectures were linked in that they all related to the lack of perceived value of attending lectures. Students missed a lecture because they did not "think it was worth going to". 50% of the students explained that they could get the notes from somebody else or from the on-line service. 75% students claimed that lecturers normally only went through the handout (already provided) or that the information was available in the textbooks. Other reasons why some lectures were not considered worth going to were that they were "boring", "a waste of time" and "unnecessary". These attitudes indicated low motivational levels and perhaps a lack of interest in the subject students were studying (Kottasz, 2005). Course quality is significantly correlated with absenteeism from class, if a student rates a course as “very good”, he misses 0.4 less classes, on average (Wolbring, 2010). Wolbring (2010) get a highly significant correlation between quality and attendance of 0.7.;
d) *Year levels of students* – the practice show that there is a significant difference between the year level of students and their lecture attendance. First and last years students usally attend lectures regularly at the same level around and above 80%, compare to intermediary years students. Course levels contribute to the level of participation of students in lectures Fritschner (2000). Dropout increases with higher semester and lower number of courses attended (Wolbring, 2010). Riffell and Sibley (2004) revealed in their study that there is also a difference in the general lecture attendance rate between first, second and third year students. Kottasz (2005) found the similar results, percentage of lectures attended by first

year students and third year students were almost identical 83.3% and 83.7% accordingly, compared with the second year students (77.6%). The reason for that results, Kottasz (2005) explained as: "first year students may still be unfamiliar with the tertiary institution and are cautious not to miss important information; whereas third year students are close to finishing their qualification and thus attend classes to ensure that they gather all the necessary information to pass their final examinations. Second year students; however, may be more relaxed because they are in their intermediary year – thus not new to the system, or in the final stages of completion of their studies. They may also feel that they are in control of their studies with lots of time to catch up if necessary, and therefore place less emphasis on attending lectures".;

e) *Face-to-face interaction* – usually a high percent of attendance (above 80%) correlated with a high level of interactions performed during the lectures, students ask questions when they are satisfy from answers. Opportunity to ask questions were amongst the chief reasons for attending lectures (Bati et al., 2013). Students seem to have a preference for more physically attractive instructors and derive utility from attending their classes and interacting with them (Wolbring, 2010). According to the student classification, students generally participate with the help of face-to-face education in all of the courses are a minority. However, with the course-specific classification it can be observed that more than every third student participates purely through face-to-face education in some individual courses (Hakala&Myllymäki, 2011). Participation in the web-based instructional environment tends to be lower while comparing to participation in the face-to-face courses (Yukselturk E. 2010).;

f) *Interest and enjoyment* - student claimed that never miss a lecture purely for the reasons of interest and enjoyment (intrinsic motivation), students' individual dispositions, prior interest in the course content, general study motivation (Becker&Powers 2001; Berger&Schleußner 2003; Kottasz, 2005; Wolbring, 2010). Studies show that dissatisfied and low performing students have a higher propensity to drop class (Bosshardt 2004; Dobkin, et al., 2007) and withdraw from studies (Yorke 1999).;

g) Size of group – our results on student's attendance showed that small groups (approximately 12students) tend to have high level of attendance around 50 to 75%, compare to large currents composed from many groups. Those results are comfirmed by Wolbring (2012), in his investigation has been obtained similar result: "if course size rises, it becomes more difficult for instructors to keep track of individual absenteeism. In result, an increase of course size by 100 students is associated with an increase in average absenteeism by 0.2" Prior research suggests that these variables might include course and instructor characteristics such as course size, mandatory attendance rules, difficulty of course contents, weekday and time of the course, and physical attractiveness of the instructor (e.g., Arulampalam, Naylor, and Smith 2008; Becker and Powers 2001; Bosshardt 2004; Devadoss and Foltz 1996; Hamermesh and Parker 2005; Wolbring, 2010).;

h) *Social and teacher-student interactions* - some believe technology reduces important human contact (Valdez, 2005). Technology is important, but small class sizes and plenty of teacher-student interaction is important, too (Elliott, 2013). Researchers found that students tended to obtain higher grades on the courses with high levels of interaction in the courses (Yukselturk E. 2010).;

i) *Need of performance* – if students want to obtain higer mark, they regularly attend lectures and take notes. Needing a performance record significantly reduces absence (Wolbring, 2010).

It appears that the factors preventing students from attending lectures are mainly individual. Weekday and starting time of the course significantly affect class attendance. Classes on Monday, Wednesday, and Friday, as well as early in the morning (8/9 a.m.) are attended less regularly

(Wolbring, 2012). Kottasz, (2005) found that only two students out of the 12 attended all their lectures with a further four missing only 2 or 3. The major reason why students had missed lectures was because they needed to work on assignments (Kottasz, 2005). Amongst the most frequently cited causes of non-attendance were: sleeplessness, ill health and the inefficiency of lectures in overcrowded halls are emphasized (Bati et al., 2013). Students claimed to miss more tutorial sessions than lecture sessions (Kottasz, 2005).

4. Helping online learners to be successful

There are a number of principles which are fundamental in order to improve the quality of education (Improving Educational Quality, 2000):

- Learn from and with people;
- Go at the pace of the stakeholders;
- Learn progressively;
- Link learning to action;
- Be flexible and use friendly approaches;
- Use triangulation and multiple perspectives;
- Search for reasons why;
- Be inclusive among and within groups;
- Promote voluntary participation.

Blended learning is a commonsense concept that results in great learning success (The Most Effective Training Techniques, 2013). The utility of the blended learning solution can be evaluated not only by participation in education but also in relation to learning outcomes, considered learning outcomes by focusing on course completions and grades. Course attendance, performance, and students' evaluations of teaching seem to be directly related (Babad et al., 2008; Berger&Schleußner, 2003). Teachers are expected to meet the needs of all students and move them toward fulfillment of their individual potential (Valdez, 2005). To help online learners be successful, instructors must understand how the blend of technology, pedagogy, and content can provide meaningful learning experiences for learners (Burns M., 2012).

The answer of one question is very important: "Does the use of advanced technology really help students learn and retain information" (Elliott, 2013). Technology actually assist to make teachers and their students more successful (Valdez, 2005). On-line systems and media help students gain a better understanding of the subject matter. Links to informative sites that present subject content in ways that are more adaptable to different student learning styles are also helpful (Technology and Teaching, 2013). Similarly, it seems that the increased participation brought about by videos has a positive effect on course completion. Thus, provision of videos can be seen to demonstrate an indirect positive effect on learning outcomes. On the other hand, the use of lecture videos does not seem to have any effect on grades obtained (Hakala&Myllymäki, 2011).

5. Conclusion

Taking into acound the factors that influence on the students attendance and success, the quality of education can be improved in the future, which is a main goal of all faculties and institutions. Uses of technology have different assessments depending on one's personal beliefs and viewpoints of what is good and bad in education. Use of modern technology in lectures as videos, for example, facilitates participation in a course and thus understanding of the topic and success. Neverdeless, demanding a high performance record is the main motive that significantly increases attendance of lectures, student's inspiration, classroom face-to-face interaction, student's activities and success.

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Opportunities for students to evaluate the electronic courses (According to the teacher)

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Abstract

The report examinate the students' opportunity to evaluate the e- training courses in order to increase their quality and efficiency. Review has been made based on various author sources that indicate the types and stages for fulfillment of assessment and the feedback from students and the formation of a culture for evaluation. Strategies for overcome the confrontation to the evaluation of e-courses by students have been studied through planning, collaboration, creativity, respect and personal responsibility.

Key words: evaluation, quality and efficiency of e-courses

1. Introduction

Development of advanced technologies and their penetration into various areas offers a unique opportunity for young people to engage in economic and social life. Digital technologies created possibilities for improvment the activities of teachers and students. They expand opportunities students and colleagues to participate in the management of education and its quality. At the same time necessitate acquiring new knowledge, skills and competencies for teachers and students. Modern technology and tools create a new educational environment where constant feedback between participants and the ability to assess educational content of the courses and learning process exist, which is a key factor in the quality of education.

Students' evaluations of teaching (SET) are a widely used instrument and a central component of a New Public Management in higher education that assure and raise teaching quality at universities around the globe. Many departments report that results to the faculty and also use average course ratings to compare and rank courses (Wolbring, 2012). Students' evaluations of teaching are based on at least three empirical assumptions (Sporn 2011):

- ***Assumption 1:*** Students' evaluations of teaching are valid measures (of students' perception) 1 of teaching quality.
- ***Assumption 2:*** Students' evaluations of teaching are fair measures (of students' perception) of teaching quality.
- ***Assumption 3:*** The quality of different courses (as perceived by the students) can be compared based on SET.

In the conditions of European educational space, and in global dimension, the forms, admission, the opportunity of cooperation between learners and educators in determining the content, in learning process and training technologies, and evaluating the quality of educational services are condition and a prerequisite for competitiveness.

Studies were conducted with academic staff and students of specialty "Food Technology" in Faculty of "Techniques and Technology" – Yambol, included in the e-learning system. Data were analyzed that express the views of teachers regarding student's opportunity to assess the quality of e-courses, activity tasks and curriculum. On the basis of comparative analyzes with analogous surveys and good practice provides conclusions and recommendations for improvement of feedback.

2 Theoretical backgroundand

In response to the needs and requirements of young people for lifelong learning and acquiring additional qualifications, continuously are expanded opportunities for electronic and distance learning. Therefore evaluations of online electronic courses, process of teaching and scientific interest took place. Various authors analyze the possibility of evaluating the course in the stage of implementation and piloting, taking into account the views of students and other teachers. Emphasis is placed on the semantic side. Students are required to give opinion whether content meets the objectives of the training needs and their expectations, and whether the style of presentation is appropriate. Many authors recommend electronic courses enable to collect the views of learners through online questionnaires. The collected information is analyzed and used in the development and improvement of the content as well as to settle the final version of the course. Henderson and other authors (2007) believe that the initial and ongoing assessment is not sufficient to carry out major changes in the curriculum.

Sorenson and Rainer (2003) provide an overview of the opportunities for online evaluation of courses by students. The authors outline a number of advantages, such as time savings, flexibility in the design and reporting of data, increasing the quantity and quality of student responses and reduced training and support costs. Additionally, the authors highlight a number of logistical and organizational challenges for online assessment systems and make recommendations for addressing these challenges. According to Skrivan (Hides, 1976) relevant to the objective evaluation is the assignment of clearly defined goals with which students must to be familiar with. For this purpose, the author states that it is essential to develop a comprehensive procedure for assessing the content and meaningful part of the training course and the quality of the e-materials.

Analysis based on student assessment on the process of learning revealed by Cashin (1999) found more than 2,000 publications on that topic. Under examine are the development instruments, validity and reliability of the evaluation, as on the problems are working a number of scientists (Arreola, 1995; Aleamoni, 1987, Feldman, 1978; Theall&Franklin, 1990). Alternatives are suggested about the responsibilities of conducting the evaluation as some engage the teachers to carry out the assessment, and others - the administration or the program coordinators.

Study of Compora (2003) for implication of student’s assessment for given program or course shows that it is not obligatory for all studied institutions. He state of necessity to implement initial and final evaluations of individual courses within a specified period and to combine as continuous/developing thus and general evaluation.

Harrington&Reasons of the University of Southern Indiana developed a project for the construction of evaluation system of e-courses in the university.

Our researches and experience show that in the development of e-courses most authors have prepared questionnaires that enable occasion for assessment of students and the obtained information is stored. We have data from our faculty that more of the teachers have conducted studies on the reliability and validity of the instruments for the assessment of courses by students. We believe that the Faculty has the option of using the Internet to collect data of student assessment, which will streamline the activities of both teachers and management of data collection and preparation of analytical reports. From the pedagogical point of view, the current and final evaluation of the electronic courses will enable to reflect the interests and needs of students as to the content thus and to the procedural side and course design.

The challenge for many authors and for us is the selection of appropriate tools of assessment, which tools and instrument for evaluation to be used according to the specifics of the curriculum, whether the results are available or access to be restricted for internal use only and others.

During his work on the problems of e-learning and its assessment, Cheung (1998) formulated some basic principles related to evaluation of teaching:

- diagnosis of the condition and feedback to improve the quality of academic teaching;
- make informed decisions based on information received from the faculty and administration;
- providing systematic expression of the needs and views of students;
- development of research on e-learning;
- control the quality of education;
- collecting information for the purpose of accreditation;
- comparative analysis of data from different courses compatibility standards;
- promoting the development of academic staff.

In order to build more comprehensive picture of the quality and effectiveness of training is needed in the evaluation of courses by students to include the effectiveness of the technology and teaching effectiveness. One of the problems which found, but it is referred and by other universities is how to optimize the questionnaires to the students so as to provide the necessary information to stakeholders without being too bulky and complex.

The analysis of literature and the research on the issue for online, traditional or combined assessment of the courses shows that there are controversial reports about the objectivity of the results. According to Avery et al. (2006); Benton et al. (2010); IDEA, (2011); Nulti, (2008) online ratings given lower scores on the style and teaching quality than traditional. From a psychological perspective is emphasizes the emotional contact and peer influence from the teacher, where the questionnaires are completed at the time on the paper. Interest produce the study of Kulik (2005), who found that the amount of the difference is small and statistically not significant, and Chang (2004) - large, statistically significant differences, i.e. differences between the mean scores of the two methods of research on rating are in conflict. We accept the explanation of Ch. Harrington and S. Reasons that online ratings are sincere and are filled without the influence of the teacher than those on paper.

We want to accentuate that for building a database that we can use for comparison and evaluation of different courses must use the same method of measurement and do not compare ratings obtained with different methods. Interest to improve our work in evaluating e-courses in the faculty is that online interviews are given much more (5 times) written comments and recommendations (Hardy, 2003), which contributes to improving the quality of e-learning. This author assumes that these results are due to the lack of time constraints limit the influence of the teacher and a great opportunity for freedom of responses and preferences of students for online written comments.

3. Methodology and results of the study

Faculty "Techniques and Technology" has a long tradition in the development of an e-learning whose range is constantly expanding. A part of the e-course is an opportunity for online surveys, while other feedback opinion and assessment of students is carried out through questionnaires on paper. In the past year, a survey have been conducted with teachers who have experience in e-learning as part of the questionnaire is related to the ability which give to students for assessment of the course, the learning process, the activity of the teacher and the curriculum.

Data graph confirms the results of our previous studies and the opinions of other authors that most teachers use the opportunities and benefits of traditional and e-learning. Our observations and conclusion are confirmed that the preferences for the use of various forms of training are determined by professional training, style and culture of teaching, rather than by age. Although dominated professors in ranging from 41 to 60 years, and the group of teachers from 31 to 40, and over 60 are of the same number, the majority combine different forms and methods.

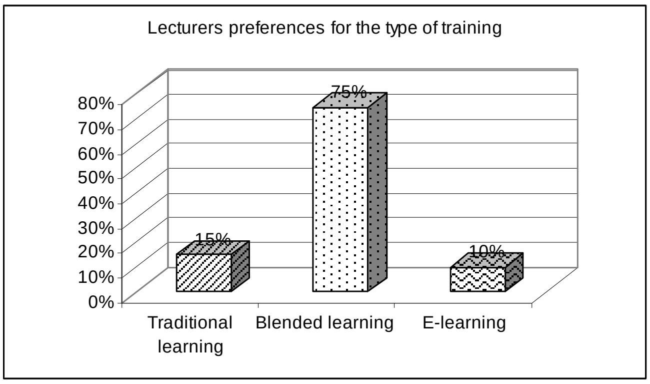

Fig. 1 Preferences of teachers for the type of training

The results of the responses to the question "Do you give students the opportunity to evaluate e-courses?“, display that 66.67% have provided such an opportunity in their courses. The question does not require specifying whether a survey on paper or online. Our standpoint is that regardless of the chosen forms of training are necessary mandatory to conduct currently and a final evaluation from the students, as it plays an important role in feedback to the teacher's self-reflection and the ability constantly to update and improve the course.

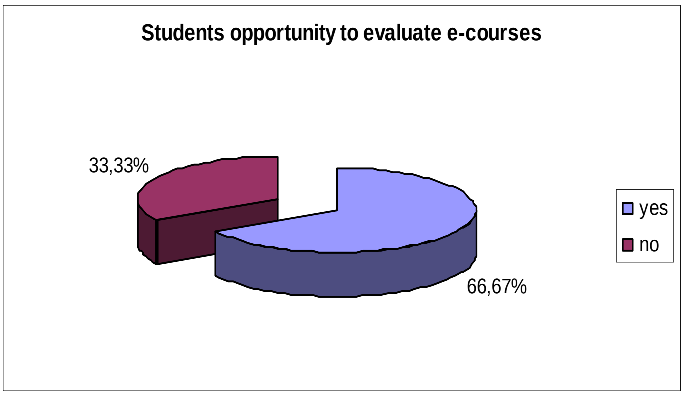

Fig. 2. Student’s opportunity to evaluate the e-courses

Faculty conditions allow conducting online survey, but student motivation at the time is not developed enough and they need support and cooperation from the teachers and guidance. Interviews with teachers and students confirmed the findings of Chen and Hoshower (2003), which emphasize that the motivation of students to participate in the rating system depends on: *improving the quality of teaching; improvement of content and form of its presentation; management decisions on the status and career development of teachers.*

To improve the quality and effectiveness of education, academic staff should monitor the results of the evaluation to be able to meet the requirements and expectations of students in a timely manner, to detect weaknesses and shortcomings in its actions and to improve it so as to expand academic performance of students.

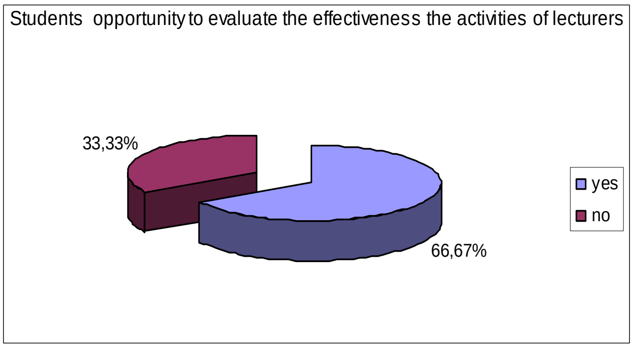

Fig. 3. Opportunities for students to evaluate teacher's activities

Logically, the overall assessments of the training course (content side, structure, design, technology and management) are associated with diverse activities of authors and performers, i.e. teachers.

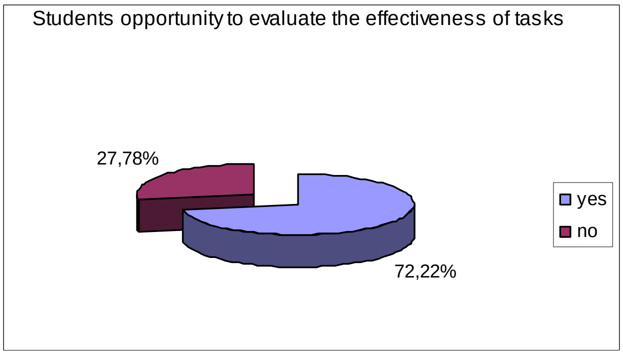

Fig. 4. Opportunities for students to evaluate the effectiveness of the tasks

Slightly higher is the percentage of positive responses that are associated with the possibility of evaluating the tasks. This can explain the fact that they are more specific, usually have a practical character out for a shorter period of time may be differentiated and linked to ongoing assessment of students and successful completion of the course.

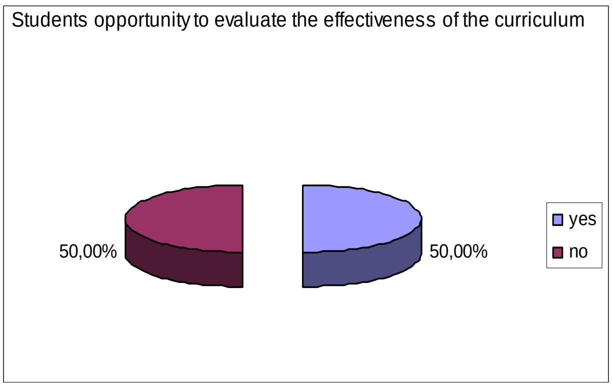

Fig. 5. Student's opportunity to evaluate the programs

Concerning the possibility for specifying the scope and topics of the content in the curriculum, the subjects were divided into two groups by 50%, suggesting that some of the faculty is not sufficiently confident in the ability of students to give objective assessment because of the degree of preparation, life and social experience and more.

We think that efforts must continue to have involvement of more teachers to use electronic or blended learning and overcome their fears of getting low scores and ratings by students. To use wider the possibilities of modern technology to create a database of opinions and assessments of students' compilation and statistical treatment of results, this will enable comparison and continuously improving the quality of education.

In the study of R.Berk (2012), the author identifies 20 strategies and possibilities for combination in order to increase the motivation of students to participate in an online evaluation of e-learning, the role and tasks of the teachers and the administrators. We consider that we can choose a combination of strategies, depending on the mission of the faculty, the style of academic teaching and academic culture. We could take advantage of the teacher's recommendations to coordinate communication with students to overcome their apathy, as highlight the role of their position and their responsibility for improving the effectiveness of learning.

In order to enable research results of students' opinion to be comparable, it is necessary to ensure standardized conditions, to reach a consensus on the use of one form of assessment.

4. Conclusion

Based on data from the past and the present study suggest to continue further the study and the creative application of best practices models, and strategies for evaluation.

The applying efforts of teachers and guidance for elimination and reduction of the reasons that discourage students to participate in the evaluation to be continued.

To achieve the consensus from all academic staff on the system and the combination of strategies for evaluating e-courses.

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Possibilities for students to evaluate and improve electronic courses (Students opinion)

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Abstract

The report based on the conducted survey that inspected the students' opportunity to interact with educators in order to assess the e-training material and courses to achieve higher quality and learning effectiveness. The activity of students in collaboration with the tutor and the positive attitude to subject is the key for successful acquiring of knowledge and effective learning process. Students accepted new technology interactive tools as good approach for training and have positive outlook to blended learning. The chance to take into accounts their opinion and collaborate with teacher makes them more responsible and effective learners.

Key words: evaluation, quality and efficiency of e-courses, blended learning

1 Student's Course evaluation

Nowadays, a wide range of course evaluation systems, both paper and electronic are available. Course evaluation technology becomes an integral part of a university's overall evaluation process (Franz et al., 2013). A course evaluation is a questionnaire - traditional paper evaluation forms or electronic. The questionnaire consists of questions permitting evaluation of the quality of courses. The student's inspection estimated such aspects as teaching approach, class atmosphere, and course organization as well as and student satisfaction with a course in common.

Course evaluations are implemented in one of two ways, either **summative** or **formative**. Student evaluations are formative when their purpose is to help faculty members improve and enhance their teaching skills (Mohanty et al., 2005). An objective evaluation of students helps faculty members to eliminate drawbacks and improve the quality of their courses. The quality of courses determines the quality of the curricula. Summative evaluation occurs at the end of a semester, usually a week or two before the last day of class.

Course evaluation technology is divided into two groups:

- *Traditional* paper-based;
- *Electronic* evaluation.

The electronic evaluation system is used for general assessment of the quality of courses. Typically, these evaluations are combined with peer evaluations, supervisor evaluations, and results of student's test scores to create an overall picture of teaching performance. Studies have reported low response rates from students when given the option to complete the evaluations online (Avery et al., 2006; Dommeyer et al., 2002; Nulty, 2008; Kinash et al., 2011).

The report based on the survey inspected the students' opinion and opportunity to interact with teachers to evaluate the e-training material and courses, in order to achieve higher quality and learning effectiveness.

2 Improving response rates of student’s evaluation

Evaluation technologies range from pure paper-based systems to hybrid systems that combine paper with web-based services, to online-only technologies. Evaluation philosophies differ depending, for instance, on whether the system is focused on supporting faculty development or on assessing faculty performance (Franz et al., 2013).

Based on Marsh (1984) study, students' evaluation ratings are:

- *Multidimensional*;
- *Reliable* and stable;
- *Primarily* a function of the instructor who teaches a course rather than the course that is taught;
- *Relatively* valid against a variety of indicators of effective teaching;
- *Relatively* unaffected by a variety of variables hypothesized as potential biases;
- *Useful* by faculty as feedback about their teaching, by students for use in course selection, and by administrators for use in personnel decisions.

Usually the results of student evaluations are provided to a teacher who was evaluated. Head of a department also receives the results. The results of course evaluations can used in several ways:

- by a *faculty* member to improve his/her course;
- by a *department* head to improve the teaching and learning process in the department;
- by a *department* head to evaluate a faculty member’s work in the end of the academic year;
- by the *administration* of the University in renewing an employment contract with a faculty member.

Course evaluation can serve a wide range of purposes (Rathke and Harmon, 2011):

- Instructor feedback for *teaching improvement*;
- Evaluation of class quality as a means for *course improvement*;
- Collection of information in support of *program/institutional accreditation*;
- Evaluation of *faculty performance* in the context of promotion and tenure procedures;
- Assessing student *learning outcomes*;
- Collection of information for *program review*;

According to Anglim and his team (2005), critical issues in online evaluation systems include:

- *security, confidentiality and anonymity* - security (a) so that only the students enrolled in a course can fill out the evaluation forms, and then only once, and (b) so that an online system cannot be “hacked” and compromised; confidentiality and anonymity so that both students and faculty can be properly protected;
- *student response rate and how to achieve a high rate* of students completing online questionnaires;
- *procedures for insuring a quick turnaround of results* so that instructors get student feedback in a timely fashion;
- *accessibility and ease of use of online evaluation forms.*

Electronic student evaluation has response rate significantly lower than paper-based surveys. Nevertheless, the feedback conveyed a clear and consistent message that students prefer electronic student evaluation of teaching because of enhanced anonymity and convenience and less time pressure.

According to Kinash and his team (2011), the reason for the low responce rate is that students expressed doubt as to whether the feedback they were providing course and after-course, semester-after-semester was being read, taken seriously, and acted upon.

3 Methodology and results of the study

Surveys have been conducted with students from different specialities (fig. 1) of Faculty "Techniques and Technology", who have experience with e-learning. In the study were participated 103 students, from them 65% men and 35% women. Parts of the questions were related to the ability for assessment of e-courses, learning process, teacher approach and their satisfaction from the curriculum. The evaluation process was absolutely confidential for a student.

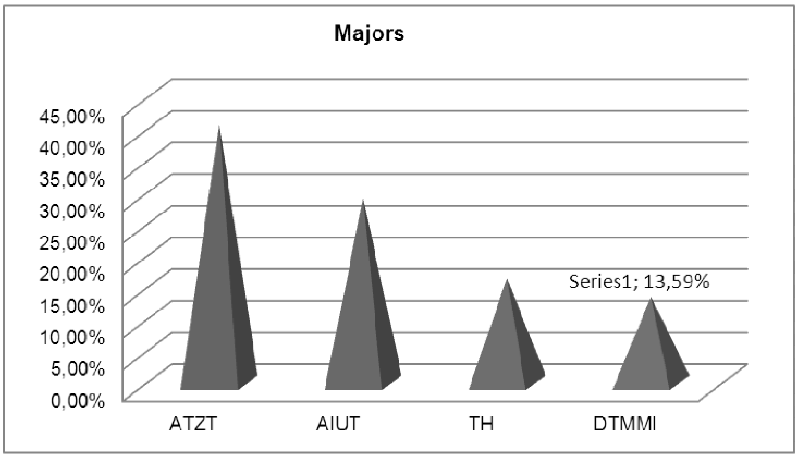

Figure 1. Specialities of students replied to the survey

Students pass in different types of training and have had opportunity to declare which type of courses they prefer. Most students 58% express their preferences toward blended learning approach (fig. 2). That is proven hybrid education uses online technology to not just supplement, but transform and improve the learning process. Blended or hybrid learning is accepted as a snazzy, yet relatively new tool, and not all professors use it the same way (The Definition of Blended Learning, 2013). In the Faculty "Techniques and Technology" most teachers use the opportunities of blended learning, only 15% of faculty staff still prefers pure traditional face-to-face teaching approach. Nevertheless of the chosen methods of teaching it is necessary mandatory to be collected currently and a final student's evaluation of course. Those play an important role as feedback to the teachers and give the ability constantly to update and improve the course.

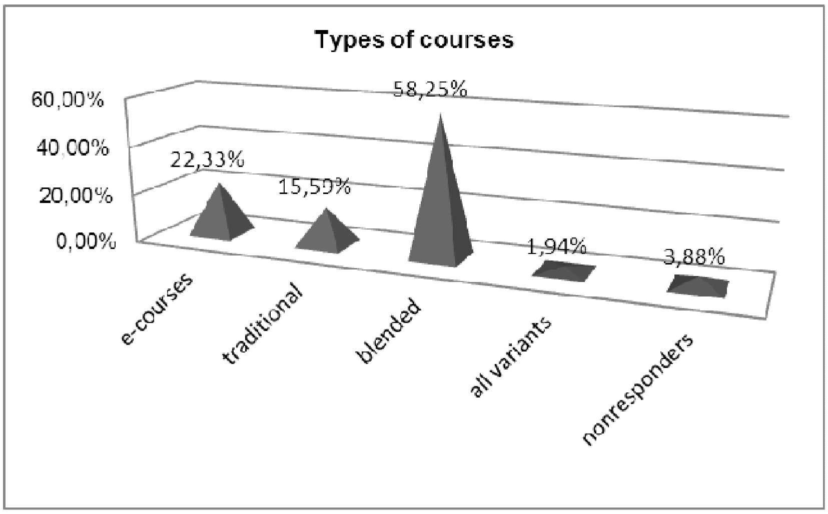

Figure 2. Preferences of students about type of courses

Most professors in blended classrooms use Blackboard and Moodle perhaps two of the best known CMS applications today. Through platforms like these, students can access video of lectures, track assignments and progress, interact with professors and peers, and review other supporting materials, like PowerPoint presentations or scholarly articles. Even if all professors used the same platform, however, they could each integrate them into their classrooms differently (The Definition of Blended Learning, 2013). Consequently evaluation of applied e-couse is an important element for real review about the acceptance of the course from the students. Prominent part of questioned learners 67% considers that they actually have option to evaluate offered e-courses (fig. 3).

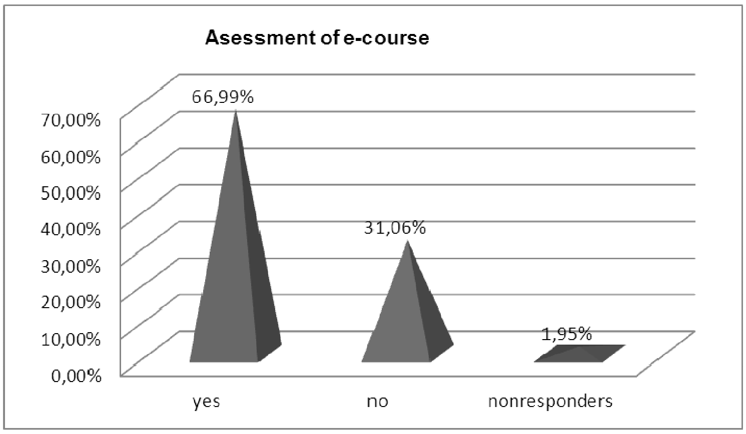

Figure 3. Student's opportunity to evaluate the e-courses

Prime goal of educate institution is to improve the quality and effectiveness of learning, academic staff should monitor the results of the assessment to meet the requirements and expectations of students appropriate. The half of students 55% considers that they have opportunity to express their estimation about teacher's presentation (fig. 4). The question of doubt is whether student evaluations of teaching accurately reflect a professor's success in helping students learn. Many charge that evaluations actually undermine learning by encouraging lenient grading and superficial classroom presentations (Johnson, 2003; Clayson&Sheffet, 2006; Emery et al., 2003).

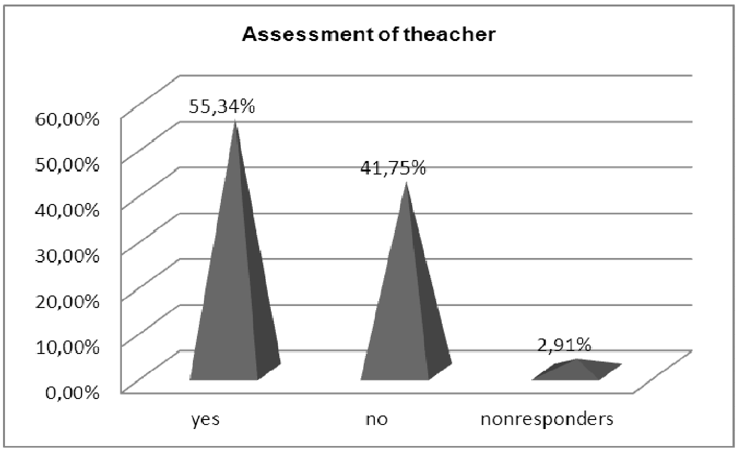

Figure 4. Opportunities for students to assess teacher's performance

Psychology research demonstrates that the human mind functions along two very different tracks, one that generates automatic, instinctive reactions and another that produces more reflective, deliberative decisions (Sloman, 2002). According to Merritt (2008) the way that usually is obtained teaching assessments from students taps their instinctive rather than reflective judgments. Scholars have voiced about student evaluations of teaching. Extensive research by psychologists and educators convincingly demonstrates that these evaluations are biased. These biases do not arise because students are incapable of evaluating teaching. Conventional student evaluations are strongly influenced by a professor's smiles, gestures, and other mannerisms, rather than the professor's knowledge, clarity, organization, or other qualities more clearly associated with good teaching (Merritt, 2008).

The cumulative research suggests that there is little, if any, positive association between the ratings students give faculty and the amount they learn. The most recent study, in fact, suggests a negative correlation between evaluations and learning. The professors with top evaluations did not prepare students for the more advanced course as well as lower rated faculty did (Yunker&Yunker, 2003). Hence more objective, unbiased and reliable appears the assessment of task rather than teacher performance.

Questions regarding training tasks evaluation are more specific, usually have a concrete application and linked to student's satisfaction and effective accomplishment of the course. On the fig.5 is presented the opinion of students about their possibility to provide assessment of learning tasks. High percent about 68% of reviewed students declared that they have opportunity to evaluate the task, and teacher requests regularly their feedback in order to improve the offered training tools.

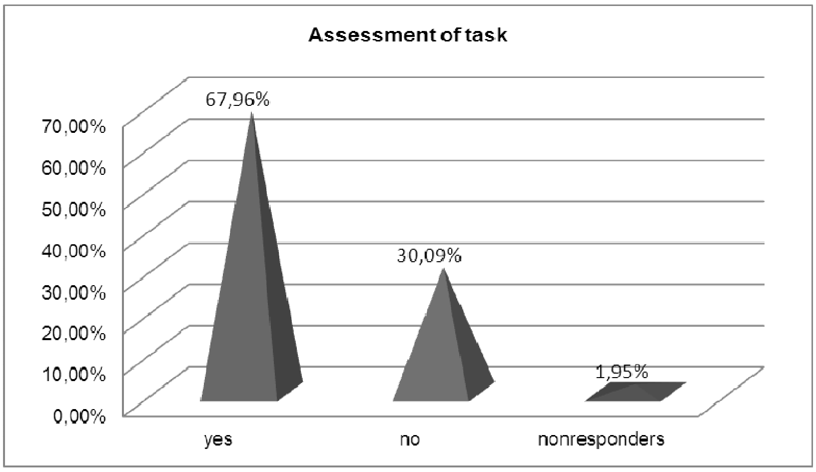

Figure 5. Opportunities of students to evaluate the tasks

According Merritt (2008) students' evaluations provide essential feedback to faculty on teaching and as consequence improving the curriculum:

- *State* lecturers what students learned from a course and how that compared to what was expected to learn*;*
- *Define* the educational techniques that worked for students and those that did not;
- *Provide* suggestions for how a faculty member might teach differently.

Improving the curriculum is an important part of the faculty work for their further legality and accreditation. Nonetheless obtaining useful feedback from any evaluator requires gathering information under circumstances that allow meaningful and deliberative reflection.

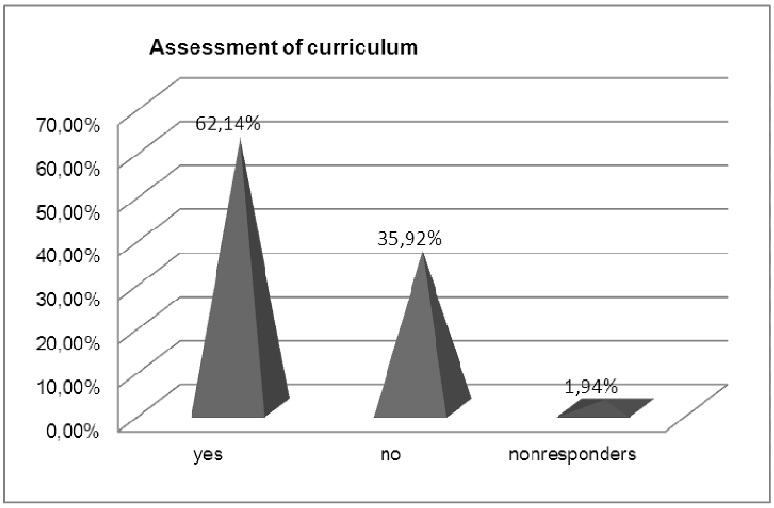

Figure 6. Student's opportunity to evaluate the programs

Student assessment and evaluation are an integral part of the teaching and learning process, therefore, must be thoughtfully integrated in the planning and delivery of curriculum. Curriculum exists for students; hence, it is normal students to have occasion to raise their view. About 63% of students under investigation claim that they have opportunity to assess the curriculum. It is concerned both content and process. Content refers to what we want students to learn and process refers to how the content is managed (The Alberta Teachers' Association, 2013).

Students require timely, constructive feedback to support their learning. Our study and experience display that students like to collaborate with teachers to labour together for enhancement of the content and supporting training tools that are delivered by tutors. Agreeing to Abbott (1990) students like informal evaluations used in mid-semester that allow commenting regularly on all courses and giving faculty members useful feedback in time to implement changes.

4. Conclusion

The collaboration of students with the tutor and the positive attitude toward subject is the important factor for successful acquiring of knowledge and effective learning process. Students accepted new interactive technology tools as good approach for training and have positive standpoint to blended learning. The option to respect their opinion for the quality of course and to collaborate with teacher for improving the way to which the content is presented, makes them more responsible and effective learners.

The main goals for future work are:

- Identifying the best practices in evaluation systems by explore the experiences of other universities;
- Figure out the basic characteristics of the preferred evaluation system;
- Recommendation of policies for switching from paper to electronic form of course evaluation data.

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Integrating Multimedia in Teaching/Learning Process by Pre-Service Teachers

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Abstract

Multimedia is attractive for pupils and it could help a better understanding of the content (for example, using simulations pupils could understand a phenomenon better than using only oral explanations). For efficiency, it is important what kind of media we use and how we integrate it in the teaching/learning process. This paper presents a research on what kind of media pre-service teachers would use, in which moment of the lesson and how they plan to integrate it and what difficulties they think they would face. Pre-service teachers were asked to make a lesson plan in which they integrate different kind of media. For each moment in which they would use digital media they have it identify the possible difficulties and solutions. These lessons plans were qualitatively analyzed. The results show that some of the pre-service teachers plan to use different digital media only for the sake of using it, without integrating properly in the right moment of the lesson or using the correct methodology. An identified preconception about computer assisted teaching is that teacher should use some digital media in every moment of the lesson. The results highlight the importance of teacher training courses on multimedia in education.

Keywords: digital media, computer assisted teaching, educational software, multimedia

1. Introduction

In the last years digital media occupies an important role in everyday life and its integration in educational process become a must. Students spend few hours every day in front of the computer navigating on the internet or watching movies. Multimedia is attractive for pupils, thus using it in education could make the lessons more interesting for them. Digital media could help a better understanding of the content if it is well designed and methodologically correctly integrating in the classroom. As the pressure on teachers for using multimedia in the classroom is quite high, they use it many times only for sake of using it, without choosing the proper media form, without using the adequate teaching methods. Thus the use of digital media is not enhancing learning.

This research studies what kind of media pre-service teachers would use, in which moment of the lesson and what teaching method they would use.

2. Theoretical background

Digital media is very various: images, films, sounds, music, animations, simulations, games, maps; or different multimedia products which integrate more media type, as presentations, educational software. In the following we present the three most used media type: images, films, and animations.

The most used media in education are images. Pictures have direct route to long term memory (Standing et al., 1970; Paivio, 1975) as they are more efficient for learning than text. Images should be meaningful to be retained (Freedman and Haber, 1974), they should be simple (Marcus, 1992; Thomson, 1994) and highlight the most important ideas related with the learning content. Thus graphical images are the most preferable (Petterson, 1993; Rieber, 1994). Text should be used to support pictures (Weidenmann, 1989), this could repeat the content of the image or it could contain some explanations (Bernard, 1990). It is important to choose the most adequate picture for the learning content.

Videos should be used for making pupil interested in the topic of the lesson or visualizing the theory. The choice of videos is important; these should be short, 2-5 minutes and should focus on the content of the lesson. If the learner can't control the video's flow of information (i.e. the film is presented frontally in the classroom), the knowledge acquisition is lower than in case of the printed text (Walma van der Molen and van der Voort, 2000). Films offer transient information, which needs to be continuously processed in the working memory, thus it can result in a cognitive overload. Summarizing helps to process transient information (de Koning et al., 2007); segmentation of information also improves learning (Hasler et al., 2007). Thus interactive videos are more efficient (Fletcher, 1990).

Animation is "a pictorial display that changes its structure or other properties over time and which triggers the perception of a continuous change" (Schnotz and Lowe, 2008, p. 304). Learning from animation is more effective than learning from static pictures (Höffler and Leutner, 2007). In order to improve the efficiency of animations, they should provide learners with control (Bétrancourt, 2005) and include spoken text (Low and Sweller, 2005). Thus exploratory animations, which "provide an explicit explanation of the entities, structure, and processes involved in the subject matter to be learned" (Ploetzner and Lowe, 2012, p. 782), are more efficient than simple animations. Animations should be scientifically correct, but simple enough to be easily understandable. The teacher should propose specific learning activities in order to enhance learning from expository animations, for example, ask pupils to make drawings to express what they have understood (Mason, Lowe, and Tornatora, 2013). Teaching students learning strategies facilitate learning from animations and the storage of information in long term memory (Ploetzner and Schlag, 2013).

It is important that media used support learning and it doesn't distract pupil from the content. We could see from the above mentioned results, that digital media is not always more efficient than printed text, its efficacy very much depends on the methodology of using it in the classroom. Usually interactivity and explanations increase learning results.

3. Research

3.1 Research design

The research was made in the first semester of the university year 2012/2013 during the computer assisted learning (CAL) classes. CAL is a compulsory subject for students who intend to be teachers. They learn this subject in their 3rd year of study, before they learn Pedagogy and Didactics. Thus, when they are learning CAL, they should already have enough pedagogical knowledge to plan a lesson. This course offers them the methodology of integrating computers in the teaching/learning process.

3.1.1 Research goal

The aim of this research is to see how pre-service teachers think to integrate digital media in the teaching/learning process. The research intends to answer the following questions:

- How many different media type pre-service teachers intend to use in a lesson?
- In how many different moments of the lesson pre-service teachers plan to use digital media?
- What methodology pre-service teachers use for integrating digital media in the lessons?
- What difficulties pre-service teachers predict and how these difficulties they plan to overcome?

3.1.2 Research sample

In the research students with Psychology and Special Education specialization of Babes-Bolyai University have participated, in total 60 students. 12 students are male and 48 students female.

3.1.3 Research methodology

Each student was asked to write a lesson plan in which they integrate digital media. These lesson plans where quantitatively and qualitatively analyzed.

3.2 Results and discussion

3.2.1 Different media types used in the lesson

The most frequently used media type is film; it is integrated 42 times in the lesson plans (Table 1). Films are used for raising pupils' interest to the subject of the lesson (15 times), for illustrating the knowledge from the new material of the lesson (13 times) and for knowledge fixation (14 times). This popularity of films could be explained by the fact that this media type occupies an important role in students' leisure time (Feierabend and Rathgeb, 2009).

The second more popular media type is educational software, in fact a multimedia product. It is used for 21 times in the lesson plans (Table 1) mostly for acquiring new knowledge (18 times), but also sometimes for knowledge fixation (3 times).

The third most frequently used media resource is the quiz (19 times, see Table 1). It is used for summarizing or repetition of the knowledge required for learning the new material of the lesson (7 times), for knowledge fixation (9 times), and for evaluation (3 times). In 13 cases students planed to use an online quiz (made with a free online quiz designer) and in 6 cases students intended to make a quiz using Microsoft PowerPoint.

Other media types used (in decreasing order of the frequency) are music, image, animated film, game, online map.

Computer games could be more frequently integrated in the learning process as pupils like to play these games (Smith et al. 1997; Prensky, 2001), and well selected games could develop reading, logical thinking, problem solving, decision making, and spatial orientation abilities (Keller, 1992; Betz, 1995).

Table 1. Frequency of use of different media type in different moments of the lesson

	Summarizing the previous knowledge	Interest raising	Learning new materials	Knowledge fixation	Evaluation	Total
Image	4	-	-	2	-	6
Film		15	13	14	-	42
Animated film	-	-	5	-	-	5
Quiz	7	-	-	9	3	19
Educational software	-	-	18	-	3	21
Webpage	2	-	7	-	-	9
Music	-	4	3	5	-	12
Game	-	-	2	2	-	4
Online map	-	-	-	1	-	1

Almost half (29 plans - 48,34%) of the lesson plans integrate two different media types, 16 plans (26,66%) only one media type, and 15 plans (25%) three media types (see Figure 1).

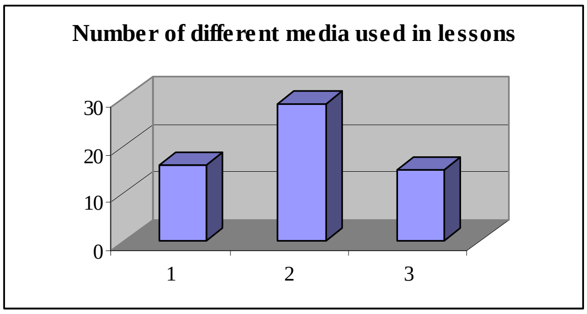

Figure 1. Number of different media used in lesson plans

3.2.2 Number of different moments of the lesson in which digital media is used

Half of the students plan to use digital media in two different moments of the lesson, 30% in a single moment, 15% in three different moments, and 5% in four different moments (Figure 2). Those students who use digital media in three or four different moments of the lesson, think that in case of computer assisted teaching the computer has to be present in every moment of the lesson or, at least, in as many moments as possible.

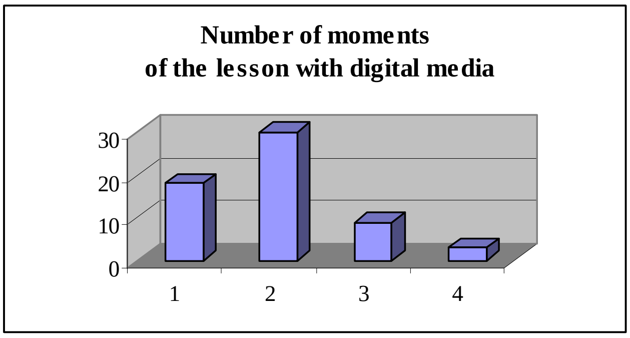

Figure 2. Number of moments of the lesson with digital media

Digital media is mostly used for knowledge acquisition (in 48 plans), for knowledge fixation (in 33 plans), and for interest raising (in 19 plans) – see Figure 3.

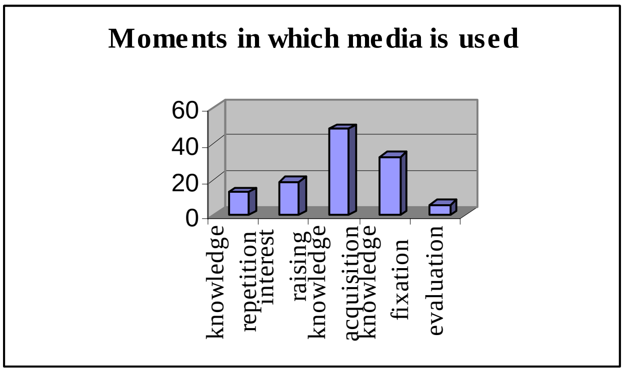

Figure 3. Moments of the lesson in which digital media is used

3.2.3 Methodology of integrating media in the lesson

The most frequently used media is film. More than half (54,70%) of the students plan a frontal activity for watching the movie. In this case films are less efficient than a printed text (Walma van der Molen and van der Voort, 2000). Then they plan to discuss with students what they have seen in the movie. This activity could improve a bit the efficacy of the use of movies (de Koning et al., 2007). The rest of those students (45,30%) who has integrated films in their lessons plan an individual watch of the film, i.e. each pupil watch the movie on a computer. This assures that each pupil has control on stopping the movie or re-watching parts of the film.

All the students plan to use educational software individually, each pupil working on a separate computer.

In case of quizzes, almost one quarter (21,05%) of the students who have included this in their lessons plan to use them frontally. In this case each question can be answered by only one pupil. To increase active participation it is better that quizzes to be solved individually, this is also the opinion of more than tree quarters (78,95%) of he students who plan that each pupil solve the quiz on a computer.

3.2.4 Foreseen difficulties when using digital media

39 plans (65%) contain information about the possible difficulties with digital media and methods of overcoming these difficulties.

Most of the students think that the main difficulty when using digital media in the classroom occurs when the computer doesn't work for some reason.

Only one student thought of that some pupils could finish earlier their work. This student would offer an educational software to study for those pupils who finish their task before the majority of the class.

Table 2 contains an example how moments of the lesson planed with digital media could be replaced with moments without digital media.

Table 2. Example of activities replacing learning with digital media

Using digital media	Without digital media
webpage: each pupil reads the ballad and solves the online worksheet; **video:** frontal watching of the video with the ballad, then discussion	**printed text:** each pupil gets the printed text of the ballad and the worksheet, reads the ballad and solves the worksheet; **game:** each pupil gets a moment of the ballad on a piece of paper; they have to put these moments in order on a timeline drawn on the floor; then each pupil reads his/her part of the ballad in chronological order.

4. Conclusions

The three most frequently used media types are film, educational software and quiz. Most of the students plan to use two different digital media types in their lesson, quarter-quarter of the students one respectively three media types.

Most of the students plan to use digital media in two different moments of the lesson, almost one third in one moment of the lesson. Media is used mostly in knowledge acquisition respectively knowledge fixation moments.

As regarding the methodology using different media types in the classroom, students integrate correctly educational software, but use in quite high percentage frontally films and quizzes.

Three quarters of the students includes discussions on possible difficulties in using digital media, but most of them think that the only difficulty which could occur is that the digital media doesn't work for some reason.

The results highlight the importance of teacher training courses on multimedia in education.

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An Effective Method for Semantic Richness Assessment of Electronic Content by Using WordNet Ontology

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Abstract

Content is one of the important elements of any electronic environments. Therefore, Web content can be the best medium for communication and collaboration. Increasing the importance of content can be investigated from two aspects: firstly from the search engines point of view and secondly, from the users' perspective. During the search, engines use keywords to find quality content and this is the main criterion for their ratings. Therefore, adding keywords is an effective method which is used by internet experts. In e-learning, the ability to measure the effectiveness of learning is important since it can be used to support educational objectives. Despite the fact that many systems are to evaluate the content, they have not yet used a developed methodology for assessing the e-content. In this study, we examine the tags which are attached by the user in order to evaluate the content. The more complete is the content in semantic richness, the more accurate users and search engines can identify the key concepts. In this paper, an evaluation architecture and algorithm have been suggested for the aforementioned purpose. Moreover, its implementation and its test are carried out in an e-learning system. In this study, Word sense disambiguation strategy based on the lexical WordNet database is considered to determine the accuracy of the tags assigned by the user in comparison with an expert. At the end, the outcome of the evaluation is compared with an expert's judgment. The results indicate good accuracy and precision of the proposed solution.

Keywords: Electronic content, assessment system, semantic richness, word sense disambiguation

1. Introduction

Content assessment make it possible to restructure the data and it is a qualitative and quantitative study. As the electronic content is in multiple formats, its evaluation encounters many challenges (Neuendorf, K.A, 2002).

In e-learning environment, the importance of content evaluation is related to the underlying fact that it has a direct effect on the learner's learning ability. In educational environments and e-learning in particular, evaluation of the teaching ability of content as a means can be utilized to advance educational goals (Kim and Kuljis, 2010). This means prior to the end of a training period, the course teaching effect can be assessed and if necessary, the required changes should be applied. There are different criteria for evaluating the content; among them are: The validity, reliability, accuracy, availability scalability, comprehensiveness and teaching ability (Palmquist, 2002).

Evaluation of content quality and received information by the user is not simply possible for him. Quality assessment of information is also important to create knowledge from information in training (Steinberg, Brehm, 2010).

Among the evaluation criteria, assessing content integration and its teaching ability, despite its critical importance, are less examined.

Our goal is to extract the hidden knowledge of user's interactions with the content and use it to evaluate the content. For this purpose, architecture and an evaluation algorithm were presented; moreover, a system was implemented where electronic content was presented to user and he/she was asked to place tags on the realized key concepts of the content. Evidently, the more teaching ability the content has, the easier is to identify the concepts by users.

2. Content Assessment

Evaluation of electronic content is important in e-Learning because there is no direct relationship between teacher and learner; thus it is essential that learner is helped to find appropriate and essential information.

Content assessment considered of the various aspects include: Quality content, content aesthetic, and organizing content. Quality content includes: the relevancy, accuracy, being up to date, completeness, semantic richness and etc. Content aesthetic is from the perspective of visual and understandable format. Organizing content is accompanied with the goal of page structure as well (Steinberg and Brehm, 2010). In the area of quality content, we assess comprehensibility (semantic richness) and completeness of the content which it leads the content teaching ability to be increased.

2.1 Assessing Semantic Richness of Content

Semantic richness refers to meaningful information which is related to content. This evaluation item can be done by means of presenting knowledge tools such as ontology and WordNet. Assessment is divided broadly into two categories, formative and summative. Formative evaluation conducted during the learning phase with goal of promoting learning. Summative evaluation conducted after the learning phase, with goal of providing suggestions for improving curriculum (Adline and Mahalakshmi, 2011).

The evaluation in this research is formative assessment during the learning period with the aim of improving learning.

2.2 Word Sense Disambiguation and WordNet Dictionary

Human language is ambiguous, so that some of the words in the content are interpreted in different ways. Computational identification of the meaning of words in text is called word sense disambiguation (WSD).

Word sense disambiguation is a process for determining the meaning of words in a particular text. A text T can be regarded as a series of words and consider WSD as a function for allocating concepts to some or all of the words in T; thus a mapping of words to concepts specifies that

[1] $$A(i) \rightarrow SenseD(wi)$$

In equation 1, *'Sense D* (w_i)*'* is decrypted meaning of the words in *D* dictionary for 'w_i' word and *A(i)* is a subset of 'w_i' meanings that are appropriate for *T* text. *"A"* map can be assigned to more than one meaning to each word.

While the best meaning is chosen which means: $|A(i)| = 1$.

2.3 Selecting the Relevant Sense

Sense of the word is an accepted meaning of the word. WSD aims to clarify the meaning of the words in a text by the processing method. A method to determine the most suitable meaning of words, concepts, is to extract a graph structure from the words meaning which is associated with the theory of lexical chains. A lexical chain is the sequence of words (w_1,.,w_n) in a text which are semantically related so that w_i is connected to w_{i+1} by a lexical semantic relation such as (is-a ‹has-part ,..); similar to the following chain meaning: eat → dish → vegetable

In general, we can consider two general methods for WSD. Controlled WSD methods that use machine learning techniques in the code samples labelled to determine the meaning and uncontrolled WSD methods are based on a set of unlabelled texts. In addition, there are knowledge-based techniques (based on dictionary and rich knowledge). In this study, we used the method based on dictionary. Glossary WordNet is our choice. WordNet dictionary is a language processing dictionary which is based on the psycholinguistic and has been created at Princeton University. WordNet dictionary codes the concepts as a set of synonymous words which the same concepts are a unique word (Semeraro *et al*, 2007).

2.4 Synonym Word Similarity Measures

Since the early 1990s, the introduction of WordNet, criteria have been developed to determine the semantic similarity of concepts in order to extract semantic network of word relationships. Semantic similarity measures are defined in equation 2:

[2] $$SCORE : SENSE_D \times SENSE_D \rightarrow [0,1]$$

Senses D is a complete set of concepts in the reference dictionary. The number of points in equation 2 is a value between 0 and 1. A similarity measure based on the distance between Sw and Sw´ has been introduced by Leacock and Chodorow. In relation (3), d (Sw, Sw´) is the number of nodes in the shortest path from the hierarchical structure of IS-A classification hierarchy WordNet and D is the maximum depth. This is our criteria in determining the similarity of user's tags to those determined by the expert (Lee *et al*, 2009).

[3]

$$score_{Lch}(S_w , S_{w'})= - log \frac{d (S_w , S_{w'})}{2D}.$$

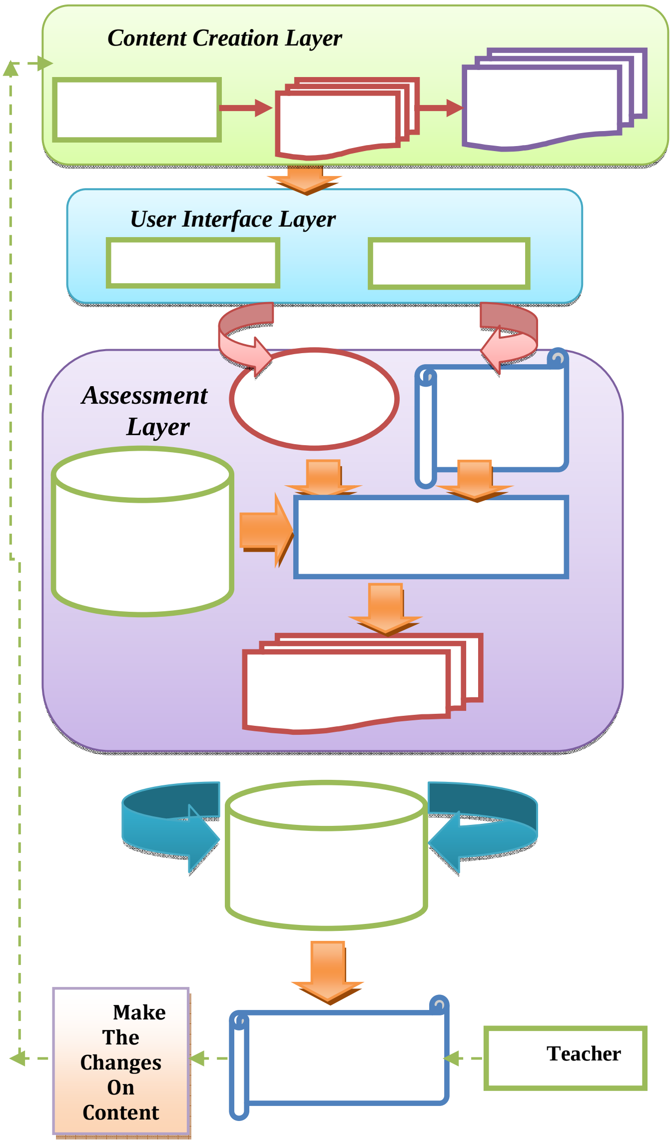
3. Proposed Architecture of Content Assessment

Hitherto, no practical method is implicitly presented to evaluate e-learning content which is collected from the interaction between a user and content. For instance in (Adline and G.S, 2011), a general architecture is considered for content evaluation which despite including various aspects of evaluation, no method is expressed for implementation and practical use. In (Seetha, 2012), a system is presented for content evaluation which scores the content quality via collecting information and learners' opinion in universities and experts' sites. The advantage of this method is to collect information from various sources and to categorize them. However with respect to explicit evaluation, learners may not always cooperate essentially.

As it is evident in figure 2, system scenario is described in four phases: content creation Layer and, the user interface layer, content assessment layer, and recorded results layers. The presented algorithm is illustrated in figure 1 section B.

3.1 Content Creation Layer

In this layer, content writer will adjust electronic content and insert it to the system. (Figure 1 section A, at top of the figure). Educational content for quick search and efficient management are generated and logged in the form of learning objects (LO). The LO are independent and reusable learning resources. According to the IEEE Learning Technology Standards Committee (IEEE/LTSC), a LO can be defined as "any entity, digital or non-digital, that may be used for learning, education or training" (Wu and Doulai, 2009).



Evaluation algorithm

The following algorithm: Algorithm of educational content assessment

Input: Educational content-Output assessment Table

d (Sx, Sy): The number of nodes in the shortest path from Sy to Sx in hierarchical IS-A - D:Maximum depth chart.

Step 1: The user name and password are entered into the system.

Step 2: If it was correct and the user is a learner, then

1 of 2: if the initial test was performed, go to 6.

.2 of 2: otherwise go to 5.

.Step 3: If the user name and password was not correct, show the error message.

Step 4: If the user name and password is correct and the user is an expert, go to 6.

Step 5: Show the test screen

Step 6: Show the lessons.

Step 7: If he is the learner, show the enter tags part

And go to 9

Step 8: If a person is the expert, display the teaching concepts keywords entry.

Step 9: Alternatively, run the "Leacock-Chodorow" algorithm for all sense of keywords.

1 of 9: Compute the distance between the two tags (d) and put it in score equation.

2 of 9: Based on specified scale (0.3) if the tag is correct, it was rated.

Step 10: Save the information of correct tags in the data base right now.

Step 11: Create the output (evaluation table) from the database.

(Section A) (Section B)

Figure 1. Assessment Architecture and Algorithm

3.2 User Interface Layer

As shown in figure 1 this layer is part of the definition of system users and their access levels. The educational content that was created by a teacher in the previous layer is being available for learners and experts of the system.

Learners study the educational content and put tag on them. These tags are the main concepts of the lesson that learners have learned them. Similarly, the lessons that were tagged by the learners will be available for experts.

The expert's task is to determine the main concepts of the lesson which are identified as keywords. Each module consists of a set of the main concepts. Expert provides the knowledge needed for the evaluation by determining the key words.

3.3 Content Creation Layer

In this process, the user is asked to place tags on the concepts he/she has learned from the lesson as the keywords of each lesson on their tags. On the other hand, the expert determines the related concepts of the content. To determine the meaning of a word in the WSD, word text is required. Consequently, we need the text of tag to define the meaning of that ambiguous tag. To find the ambiguous tag content, its adjacent tags can be used as the text. This idea is called as tag sense disambiguation and its logic is that frequent co-occurrence of two tags represent the semantic relationship between them. In this project, the key words determined by an expert specify the adjacent tags.

3.4 Recording Result Layer

In this part, the extracted knowledge from the evaluation layer is inserted to the evaluation database. The teacher will compare the results of the evaluation and will make the required course modifications and the lesson will be given to the new users for repeated evaluation.

4. Implementing the Architecture

System has been implemented with these modules and tools as expressed below:
Tomcat application server, Jsp pages, J2ee framework, WordNet java tool.

5 Testing the Proposed Method

To test the proposed evaluation method in e-learning, a web site was designed and implemented. In this system, the learners were logged and courses under evaluation were given to them. Elective courses were in IELTS vocabulary instruction field

5.1 Participants in the System

In this system, two experts in the field of education (teacher training IELTS test) cooperated. In the first phase, the primary tests were performed to determine the level of learners. Subsequently, the remaining members are divided into three categories of: elementary, intermediate and advanced (groups A and Band C) according to the results of primary test. Next, each of these groups was studied the same educational content which includes 5 courses. For the final evaluation, 21 active users were used.

In table 1, the heading row indicates courses title and heading column presents training groups and experts. In table cells, the average number of correct tags for each lesson is provided (row 2 to row 4). From row 5, both experts' estimates are presented for correct tags of each group for 5 courses.

Table 1. Comparison of assessment result and expert's opinion

	Course 1	**Course 2**
Group A	2	3.2
Group B	1.7	2.3
Group C	1.5	1.9
Group A – Expert 1	3	3
Group A – Expert 2	2.5	4
Group B – Expert 1	2	2.5
Group B – Expert 2	2	3
Group C – Expert 1	1	2
Group C – Expert 2	1.5	2

Table 2. Comparison of error percentage for users and expert for each lesson

	Course 1	**Course 2**
Error Percentage for Users and Expert 1	33.3	6.66
e Error Percentage for Users and Expert 2	20	20
Average	11.66	13.33
Total Average	12.49	

Table 2 compares the error percentage in terms of users and the expert's opinion. In the first row, the error percentage rate was estimated with the first expert's opinion; moreover in the second row, the error percentage is compared with the second expert's estimate. In the third row, the average error percentage with two experts' opinions is presented. We use equation 4 to calculate the error percentage:

$$[4] \quad ErrorPercentage = \frac{Analysis - ExpertOpinion}{ExpertOpinion} * 100$$

On average, there is %12.49 of error for all the courses assessment. In figure 2, the number of correct tags for each learner and for 5 evaluated lessons is displayed by the graphs. As is evident from the graph, the average rate of correct tags from Lesson 1 to Lesson 5 is increased. This is because we have increased the comprehensiveness of content from Lesson 1 to Lesson 5.

The dark blue colour presents lesson 1, red colour indicates second lesson, green colour is assigned for third lesson, the purple colour represents forth lesson, the blue light stands for the fifth lesson, the number of correct tags is on the right vertical axis and the horizontal axis shows the users. The red oval on the diagram typically represents the increase in the number of correct tags for the 14th student which his/her number of tags has been increased from lesson 1 to lesson 5.

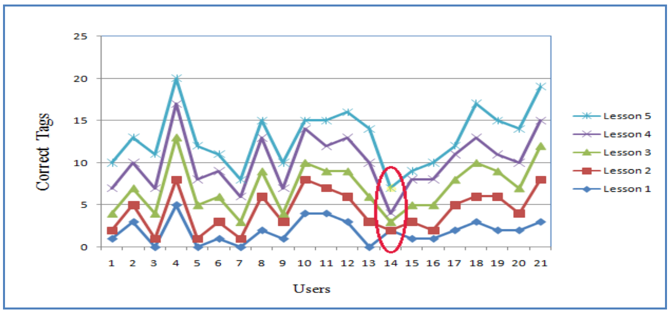


Figure 2. Chart of the correct tags on each lesson

In figure 3, the blue shows group A, the red colour represents expert 1, the green colour is assigned for expert 2, the vertical axis shows the number of correct tags estimated by experts and evaluated by users. The horizontal axis represents the lessons which have been provided. As the diagram shows, there is a very little difference

between the learners and the expert. Moreover by calculating the error percentage for 5 courses, an average for confidence factor is obtained. The error percentage is calculated as: 15.58 by equation 4.

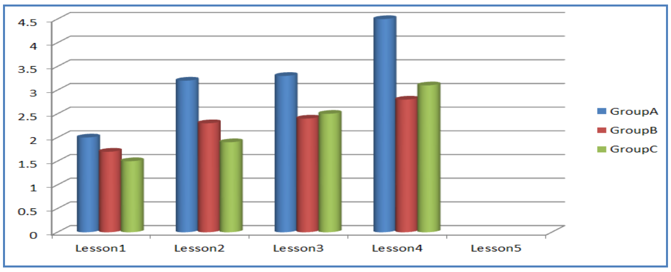


Figure 3. Comparison of expert's opinion and the evaluation analysis for lesson

6. Conclusion

In this paper, a method of assessing electronic content was presented through recording user's interactions with the content. In this study, a tagging environment was created which its aim is to recognize the rate of comprehensive and teaching ability of content. Finally, a method was presented which requires no continuous need for an expert to assess content. This method evaluates content with respect to users' opinions.

Due to the fact that learner tags the content based on him/her understanding and machine need methods and algorithms to recognize its meaning, natural language processing approach is applied to determine the accuracy of the user in the context. This is called the method of word sense disambiguation.

This method relies on lexical linguistic stored knowledge in the WordNet ontology. The Leacock-Chodorow algorithm is a method of knowledge-based WSD.

This algorithm defines a measure of similarity between the concepts based on the ontology hierarchy of wordNet.

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Enhancing Collaborative Trust Management Systems by Considering Expertise Levels

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Abstract

In recent years, a number of reputation systems have been proposed for open collaborative environments such as Wikipedia. They assign a single quantitative value to users' collaborations regardless of their expertise. Experts generally collaborate in their expertise contexts and their collaboration is generally quantitatively smaller than non-expert users that are active in a wider context. Consequently experts will gain less reputation than those with numerous collaborations. However, we know that experts' contributions in their expertise fields are far more trustworthy than non-experts.

In this paper, an attempt is made to find the expertise areas and take them into account in the reputation calculation. So if a user has expertise in physics, the content created by him will obtain more trustworthy value than other non-expert users.

Keywords: Expert Finding, Open Collaboration, Reputation System, Trust, Wiki

1 Introduction

Expert finding originally emerged to automate identifying experts in large enterprises. Experts may be searched to satisfy an information need or to be assigned to a task. Companies look for competent employees and conference organizers for suitable reviewers. However, doing that manually is costly and time consuming. Expert finding can be used to improve and optimize these tasks.

Expert finding can be performed in different domains. It was initially limited to employees within a company. With the advent of the Internet, the expert finding domain expanded. Nowadays expert finding is performed on social networks, question and answer forums and even the entire Internet domain.

In this paper we use expert finding in wikis to improve trust management systems. The idea is that experts' contributions are more trustworthy than other non-expert users.

The rest of this paper is organized as follows: In next section we review related works. In the section 3 we initially discuss the importance of considering users' level of expertise in various subjects when formulating a reputation system for a collaborative environment. Then we introduce two components of our expert finding sub-system: expertise profile and expertise taxonomy. Afterwards, we draw an overview of a reputation system that is used as a foundation for our trust system. In section 5 we show our method for expertise identification and in section 6 the method of calculation trustworthiness value is described. Finally we draw an conclusions are put forth.

2 Related work

The expert finding approaches can be grouped into two major classes: profile-based and graph-based. In profile-based expert finding, first an expertise profile is built for each potential expert. By mining the users' profile, the expertise of each user will be unveiled [1-3]. In graph-based expert findings, the interaction between users are represented as a graph and users are searched by using graph algorithms. This method is increasingly used to find experts in virtual social networks and question and answer forums [4-6].

There are some works that have focused on finding experts in Wikipedia and some trust calculation systems, proposed for collaborative environments.

Cosley et al. [7] presented an application named SuggestBot to perform intelligent task routing in Wikipedia. Similar to the SuggestBot method, Demartini [8] proposed the idea to build a profile for each user by gathering all articles that he/she has collaborated in. He uses regular information retrieval techniques to search experts. among Wikipedia users.

Zeng et al. [9] utilized revision history to measure trustworthiness of Wikipedia articles at the sentences level. Adler et al. [10] suggest a trust system in which trustworthiness is increased if the text survives successive edits and is lost otherwise. Their formulation is at the word level. Xiangju and Cunningham [11] used the centrality concept to build a trust system and Javanmardi et al. [12] used Hidden Markov Models to estimate trust and reputation values.

As our studies showed, this work is the first attempt to take into account expertise level in collaborative trust calculations.

3 Expertness and Reputation

In this section we initially discuss the importance of considering the expertise of users when formulating a reputation system for a collaborative environment. Then we introduce two components of our expert finding sub-system: expertise profile and expertise taxonomy

3.1 The need to considering users' expertise

Trust management systems that have been proposed for wikis so far assign a single quantitative trust value to all of a user's contributions regardless of their contexts. This causes users with a large number of minor contributions to gain higher reputation but experts with significant but less contributions could not gain a striking reputation. However, we know that the contribution of an expert in its expertise domain is far more trustworthy than non-expert users.

In this paper an attempt was made to identify fields in which that a user has represented his expertise and to assign a trustworthy value proportional to the expertise level. Our proposed enhancement can be applied on a wide range of collaborative trust management systems. We will use a reputation system that was previously presented by us in [13]. We draw an overview of it in section 4.

3.2 Expertise profile

For each user we will build a profile containing all of his/her contributions. When a sentence is created, its creator is its owner and that sentence will be added to the owner profile. When a sentence is modified, we should first determine the type of edit. If the new version is the result of adding a wiki (or HTML) tag, punctuation correction, proofreading or other similar modification, the owner of the sentence will not be changed and it will have no effect on the expertise profile. This is because such editing contributions do not need particular deep skills in a specific field of study. Otherwise if the edit changes the semantics of the sentence, the modifier is the owner of the new modified sentence. When a sentence is deleted, the user who performs the deletion is the owner of the resulting empty sentence (which we call a null sentence).

3.3 Expertise Taxonomy

We use the *category system of Wikipedia* as our expertise taxonomy. Wikipedia utilizes categories to link articles that are under a common topic. The categories may have some sub-categories. But categories can be a sub-category of more than one parent. Consequently, categories form a non-tree hierarchy.

Categories are placed at the bottom of each page using [[Category:XYZ]] syntax. Where XYZ is the category name.

4 Overview of a longevity-based Reputation and Trust System

To calculate the reputation of a user, we should initially gather all sentences that he/she owns. Each of his/her sentences may have a negative or positive effect on the user's reputation proportional to its longevity. The effect of sentence *i* on its owner's reputation is calculated by equation 1:

$$\text{(1)} \quad \delta_i = \frac{2\tau_i\theta^{-1}}{\tau_i\theta^{-1}+1} - 1 = \frac{\tau_i - \theta}{\tau_i + \theta}$$

θ is the time border between low and high quality contributions and τ_i denotes longevity of sentence *i*. If a sentence last less than θ, its owner's reputation will be decreased, otherwise it will be increased.

e_i is in the range of [-1,1) . The most negative effect (-1) is resulted when the collaboration is deleted shortly after its placement. If the collaboration survives in the latest revision for a long time it yields an effect near +1 for its creator.

The reputation of a user is the summation of all collaboration effects (in this paper the collaborations of a user are all of the sentences that he/she owns). Formally, the reputation of user *u* (denoted by r_u) is calculated by equation 2:

$$\text{(2)} \quad r_u = \sum_{i \in Pu} (\delta_i)$$

Where p_u is user u's collaboration profile and $-|p| < r_u < |p|$.

Using this reputation system, trustworthiness of a single sentence in the latest revision cannot be more than the reputation of the latest editor (its owner) because the latest editor can change the meaning of that sentence completely no matter how trustworthy it was before editing. So its trustworthiness is equal to its owner's reputation. The aggregate trustworthy of a wiki article named can be estimated by equation 3:

$$\text{(3)} \quad T_\alpha = \frac{1}{|\alpha| S_\alpha} \sum_{f_i \in \alpha} t_i s_i$$

S_α and s_i show the number of words in article α and the number of words in sentence *i* respectively. Also t_i is trustworthiness value of sentence f_i .

5 Expertise Identification

In this system, experts are those contributors whose previous contributions in a specific category generally exhibited high quality. To discriminate low, normal and high quality, we need to define two threshold parameters: θ' and θ'' as follows. If the resulting reputation of a collaboration was lower than θ' it has low quality. If the resulting reputation value was between θ' and θ'' it is a normal collaboration and if the resulting reputation is higher than θ'' it exhibit a high quality contribution.

To calculate a user's expertise in a category we should determine the quality level of his/her contribution using following relation:

$$\text{(4)} \quad l_i = \begin{cases} -1 & \theta'' < \tau_i \\ 0 & \theta' < \tau_i < \theta'' \\ +1 & \tau_i < \theta' \end{cases}$$

Where l_i shows the quality level of sentence i and τ_i is the longevity of sentence i. The expertise level of user u in category c is shown by e_u^c and is calculated by equation 5:

$$(5) \quad e_u^c = \begin{cases} |P_u^c|^{-1} \sum_{f_i \in P_u^c} l_i & |P_u^c| \geq \varepsilon \\ 0 & |P_u^c| < \varepsilon \end{cases}$$

We use P_u^c to show the set of sentences in the profile of user u that belongs to category c ($P_u^c \subset P_u$).

We use ε to show the least number of contributions in a specific category required to include a user in the expertise calculation process.

6 Trust Calculation

Knowing expertise levels of a user, we can now take into account expertise levels while computing trustworthy value. Thus, the trust value of a sentence that is authored/edited by an expert will be increased according to his/her expertise level. Trustworthiness of a sentence in the last revision is now equal to:

$$(6) \quad t_i = r_i \left(e_{owner(i)}^{cat(i)} + 1 \right)$$

Cat(i) and *owner(i)* show the category and the owner of sentence i respectively. The category of a sentence is the same category of the page that it belongs to. We can modify equation 3 to improve trust formulation of an article by the following equation :

$$(7) \quad T_\alpha = \frac{1}{|\alpha| S_\alpha} \sum_{f_i \in \alpha} t_i s_i = \frac{1}{|\alpha| S_\alpha} \sum_{f_i \in \alpha} s_i r_i \left(e_{owner(i)}^{cat(i)} + 1 \right)$$

As an example consider article α which is composed of two sentences f_1 and f_2 ($\alpha = \{f_1, f_2\}$). The owner of f_1 and f_2 are users m and n, respectively (*owner* $(f_1) = m$, $owner(f_2) = n$), and both reputations are equal to 50 ($r_m = r_n = 50$). The article is in category A ($\alpha \epsilon A$). All of m's reputation are resulted from his contributions in five sentences, which all are in category A. The user n has contributed in 50 sentences, four of them in category A. We get □=3, so in this example both users can be included in expertise calculation. f_i^α denotes sentence i in article α. Collaborations of m in A are $P_m^A = \{f_1^\alpha, f_1^\beta, f_2^\beta, f_3^\beta, f_4^\beta\}$ and the quality level of each of his sentences according to equation 4 is determined as 1, 0, 1, 1, 1. Using equation 5 we can calculate m's expertise value: e_m^A= (1+1+1+0+1) ÷ 5 = 0.8. Similarly, $P_n^A = \{f_2^\alpha, f_1^\gamma, f_2^\gamma, f_3^\gamma\}$ and the quality level of each of n sentences is respectively evaluated: 1, 1, 0, -1. Then $e_n^A = (0 + 1 + 1 - 1) \div 4 = 0.25$. Now we can use 6 to calculate the trustworthiness of each sentence of α:

t_1= 50 (1+0.8) = 90 t_2 = 50 (1+0.25) = 62.5

Considering $s_1 = s_2 = 1$ and using equation 7, we can calculate the trustworthiness of α as:

$$T_\alpha = \frac{1}{2 * 2} (1 * 90 + 1 * 62.5) = 15.6875$$

7 Conclusion

In this paper, we first reviewed the expert finding field of study. Afterwards, we explained why considering expertise values in collaborative environments is important. Then we drew an overview of a reputation system that was used as the foundation of our trust system. We explained how to the find expertise area of users and how to use them in trust formulation. At the end we reviewed some semi-related works.

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Using a pilot e-dictionary to teach lexicography and raise dictionary awareness

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Abstract

Dictionaries have always played an important role in the activity of language students. The technological revolution brought about by computers led to the creation of a new type of dictionary, i.e. the electronic dictionary, which is increasingly replacing traditional reference works. In this context, it becomes essential to familiarize language students with e-dictionaries, to make them aware of the potential these new tools hold when used appropriately, as well as of the possible dangers deriving from their incorrect use. Our paper examines the way these objectives can be fulfilled using a pilot e-dictionary, namely Lexica dictionary (http://lexica.unitbv.ro/). It also focuses on the Lexica dictionary as a hands-on method of understanding and learning the lexicographic principles and of implementing them by providing students with a framework which allows them to simulate lexicographic tasks involved in the different stages of dictionary-making, such as the selection of terms or of the appropriate types of information to include in the microstructure.

Keywords: lexicography, electronic dictionary, teaching

1. Introduction

The creation of a new type of lexicographic product, *i.e.* the electronic dictionary, and its tendency to replace the traditional reference works in the preferences of language students make it necessary to familiarize students with the potential of such tools, without neglecting the drawbacks deriving from their incorrect use. In our view, students' exposure to electronic dictionaries in the classroom should be aimed at fulfilling at least two objectives. Firstly, students should be thought to adequately use these products which would allow them to effectively replace paper dictionaries in their search routines. Secondly, it would be beneficial for language students to understand and learn the lexicographic principles behind these products, thus ensuring that they are aware of what they can expect from electronic dictionaries. Our assumption is that both objectives can also be fulfilled with the help of a pilot e-dictionary, in the case of our language students the *Lexica* bilingual dictionary (http://lexica.unitbv.ro/).

Bearing in mind the new challenges and opportunities for second language learning and teaching brought by Web-based technologies, the pedagogical potential of online dictionaries needs to be exploited in preparing language students. Especially since some authors claim that, in a language learning situation, "dictionary training should be an integral part of any syllabus" (Gairns and Redman, 1998: 81).

2. What is the *Lexica* dictionary?

According to de Schryver (2003: 151), the family of electronic dictionaries includes two large classes: dictionaries on a stand-alone computer – divided into hand-held dictionaries (e.g. PAD) and robust-machine dictionaries (e.g. CD-ROM) –, and dictionaries on a networked computer (intranet and internet dictionaries). The *Lexica* dictionary belongs to the second class. It is one of the outcomes of a lexicographic research project, *Competitiveness and Effectiveness in Intercultural Specialised Communication through the Optimization of Online Resources*, funded by the former National University Research Council (CNCSIS) and conducted in 2007 and 2008 by an interdisciplinary team of academics and research students from *Transilvania* University of Braşov. It was originally created as a pilot dictionary for the fields of politics, trade and law on the basis of a corpus made up of texts relating to the European Union.

The aim of this research project was to improve online dictionaries, both their compilation and their final outcome. From the point of view of the process of dictionary-making, the project team recreated all the stages involved in the compilation of a corpus-based dictionary for the online medium. The element of novelty was the development of "a text-parsing tool designed to process relevant linguistic data found in specialized texts pertaining to the European Community legislation" (Sângeorzan *et al.*, 2008: 111).

In order to improve online dictionaries as products, the research team performed an investigation of seventy bilingual and multilingual public domain amateur dictionaries involving the English and Romanian domains, available on the internet, according to a set of qualitative criteria, "firstly, to identify, diagnose, and typify the problems commonly encountered when using such internet resources and secondly, to find solutions and design tools aimed at amending them" (Sângeorzan *et al.*, 2008: 110). The conclusions of this survey were taken into consideration in building *Lexica*, a specialized English-Romanian dictionary, which tries to eliminate the flaws encountered in other online dictionaries, at all levels, i.e. mactrostructure (which refers to the stock of words and the possible ways of accessing them), microstructure (the types of information and their arrangement within the entries) and mediostructure (defined as "the various means for achieving cross-reference in the dictionary") (Hartmann, 2001: 64-65).

According to the information provided by the research team on the dictionary site (http://lexica.unitbv.ro/index.php?action=despre), the complex nature and flexible capabilities of the IT support have turned *Lexica* into a prolific metadictionary, capable of generating new corpus-based reference tools enabling meaning decoding/encoding processes in a variety of fields, as we will show in what follows (see 4).

3 Using *Lexica* as a tool to raise dictionary awareness

Considering that "a lot of students (whether prompted to do so by their teachers or not) are likely to have recourse to dictionaries", we agree with Gairns and Redman (1998:81) who believe that "it seems worth tapping this innate desire for a reference work by showing students how, in effect, a well-designed dictionary can be of greater benefit to them". As far as online dictionaries are concerned, the label well-designed can be applied to a reference work which avoids the problems encountered in the dictionaries surveyed as part of the above mentioned project, such as lack of accessibility or unreliability. By comparing *Lexica* with other online dictionaries which are available free of charge, students can be made aware of these problems and shown what they can expect or even demand from their online dictionaries, both from the point of view of their content and of the presentation of the linguistic input. Given that the dictionary in question is a specialized bilingual one, it can be incorporated into the resources available in teaching specialized translation (with an emphasis on the fields of economics and law, in European Union documents) to Applied Modern Languages students.

As for the presentation, Figure 1 below shows clearly that *Lexica* aims to increase user-friendliness. It is a dedicated dictionary, i.e. "created for the explicit and sole purpose of allowing access to the information available in a dictionary, without combining different purposes or offering other services (translation services, games, public interest information, advertising, currency rates, tourist information, *etc.*)" (Burada and Sinu, 2007: 45). The types of information available to the user are clearly marked with the help of green boxes (contexts, translations, paradigm, structures), the information is not crammed, colours and highlights are used to increase readability. *Lexica* also attempted to increase the accessibility to the stock of words through a clear and easily manageable interface, by giving the reader the possibility to modify the search or to select the types of information to be displayed on the screen through a simple click on the relevant field.

Figure 1. The presentation of information in the Lexica dictionary

Another problem, that students are not aware of most of the time, is reliability, which we have previously signaled: "the Internet is not a reliable learning environment" (Micu and Sinu, 2012: 124). Although the publishing house or the authors are an important factor in deciding which paper dictionary to purchase, in the case of online dictionaries, students do not seem bothered by the lack of information about the (interdisciplinary, we assume) team behind them. This anonymity can be interpreted as "lack of commitment on the part of the authors, who thus seem to shun taking responsibility for the output they generated" (Burada and Sinu, 2007: 40-41). Even when good professionals are involved, the lack of information about their professional stature and credentials, which "may warrant the high standards of the dictionary they authored" (Burada and Sinu, 2007: 40), can only be damaging for the dictionary in general. In the case of *Lexica*, the problem of reliability was solved (as shown in Figure 2 below) by providing data about the context in which the dictionary was compiled (in the section *Ce este Lexica – What is Lexica*) – part of a research programme developed at a university level - and about the people involved in building it (in the section *Echipa – The Team*), both lexicographers and IT experts, their institutional affiliations and their publications in the field.

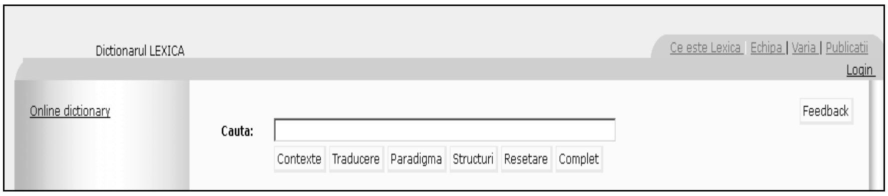
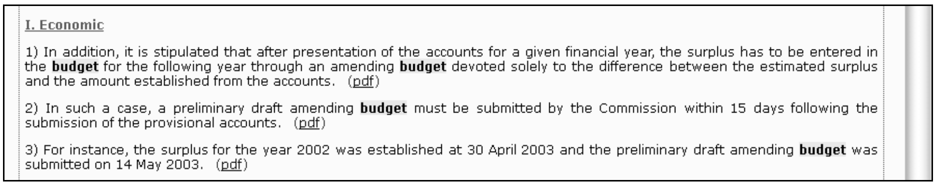


Figure 2. Interface of the Lexica dictionary

The information in the *What is Lexica* section can also help students decide if the dictionary is suited for their needs as it focuses on a specific type of terminology, *i.e.* European Union related terminology, a field which is present in the translation courses of Applied Modern Language students.

As far as the content is concerned, *Lexica* attempted to remedy some of the problems identified in the microstructure of other online dictionaries: the poor use and quality of metalanguage and/or of the translations and explanations, misspellings and typographical errors, ambiguous abbreviations, inappropriate spacing, the inadequate use of signs and symbols, lack of diacritics, the absence of contexts etc. The quality of the metalanguage and of the translations was carefully checked by implementing a set of rules to ensure consistency of the input provided by the team involved in the compilation. The rules were discussed by the team keeping in mind the users' needs for clarity and for a balanced amount of information. The spelling problems were solved by careful proofreading (also with the help of the master students in the *Language Studies for Intercultural Communication* programme).

However, maybe the most noticeable improvement brought by Lexica is the fact that it supplies original contexts and links to the source documents used to extract the terms in the word selection stage. The contexts are important because they allow the proficient user to check the behaviour of the word, its collocation patterns, as well as its translations.


I. Economic

1) In addition, it is stipulated that after presentation of the accounts for a given financial year, the surplus has to be entered in the **budget** for the following year through an amending **budget** devoted solely to the difference between the estimated surplus and the amount established from the accounts. (pdf)

2) In such a case, a preliminary draft amending **budget** must be submitted by the Commission within 15 days following the submission of the provisional accounts. (pdf)

3) For instance, the surplus for the year 2002 was established at 30 April 2003 and the preliminary draft amending **budget** was submitted on 14 May 2003. (pdf)

Figure 3. Example of economic contexts for the headword "budget"

Although proficient language learners are encouraged to use monolingual dictionaries in their search routines, it is unrealistic to assume that they will avoid bilingual ones, particularly in the case of specialized terms. Drawing their attention to dictionary aspects relevant for their quality will allow them to develop their skills in assessing the reference works they avail themselves of, and to choose the most appropriate dictionary for each linguistic task they undertake. This is even more important considering the fact that most of the dictionary work our students do takes place outside the classroom, in preparing for classes or for exams: "A learner who makes good use of a dictionary will be able to continue learning outside the classroom, and this will give him considerable autonomy about the decisions he makes about his own learning" (Gairns and Redman, 1998: 79).

In addition to increasing their autonomy, "creating and refining our language students' dictionary awareness is one step further towards their becoming more sophisticated users with a sound sense of discrimination and, as the case may be, more responsible and competent lexicographers" (Burada, 2009: 71).

4. Using the *Lexica* dictionary to teach lexicography

In keeping with the above mentioned statement, after the research project ended, *Lexica* continued as an experimental dictionary aimed at affording hands-on practice opportunities for the master students enrolled in the *Language Studies for Intercultural Communication* programme. At present, it allows students to simulate lexicographic tasks involved in the different stages of dictionary-making. Thus, *Lexica* is a valuable teaching tool as it enables the master students taking the course in *Fundamentals of Bilingual Lexicography* to correlate the metalexicographic input with the lexicographic practice.

Following the workflow involved in compiling Lexica (see Figure 4 below, taken from Sângeorzan *et al.* (2008: 111)) and using the existing framework, the master students are currently taking part in the compilation of a Romanian-English glossary for the administrative terminology used in education, project which began in 2012. Their tasks are associated with the three major stages in dictionary-making: planning, writing and production (Landau 2001:343).

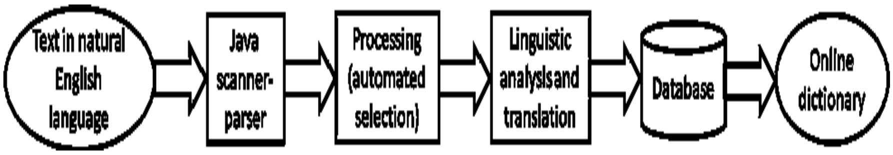


Figure 4. The complete process from input to output in Lexica

The *planning stage* began with the lexicographic decisions concerning elements such as the intended target audience, the coverage of the glossary, the types of information to be included in the microstructure. It was followed by data collection: students gathered relevant texts for the administrative field from the websites of Romanian universities all over the country; then, they formatted the texts in order to use the text parsing programme developed for *Lexica* to extract words according to their frequency. The next step was to select the relevant terms from the list automatically generated by the parser. In the *writing stage*, for each of the terms selected, students provided translations and structures. The decision to reduce the number of types of information provided, as compared to *Lexica*, was adopted in the planning stage taking into consideration the target audience and their needs. The project is currently at the writing stage, which will be followed by proofreading and implementation of the new online glossary.

Although the team of master students involved in compiling the glossary changes each year, they take part in introductory meetings whose aims are to familiarise them with the entire workflow, to encourage them to correlate the practical aspects presented with the received theoretical input, to actively involve them in discussions about the tasks they will be performing. Such a project affords our students precious practice in the lexicographic field, helping them to better understand the lexicographic concepts and principles.

5. Conclusions

Gairns and Redman (1998:79) remark the fact that many paper bilingual dictionaries “tended to be unreliable and at times inaccurate; these criticisms can still be levelled at some of them”. The situation is even more evident in the case of present day online dictionaries. As we have previously stated, “students today generally possess a high level of computer literacy and use the Internet frequently both in school related and non-related activities” (Micu and Sinu, 2012: 118). In the case of language students, this translates into the extreme importance of teaching them to fully exploit the potential of online dictionaries and to increase their sense of discrimination when it comes to such resources.

In our paper, we have tried to emphasize the double role that a well-designed pilot dictionary for the online medium can play in training language students. Firstly, it can be a useful tool in raising dictionary awareness by drawing attention to the flaws that other online dictionaries may contain. Secondly, it can serve as a school dictionary allowing master students to practice the lexicographic principles involved in dictionary compilation.

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Using ICT in Teaching:
A View from Romanian Prospective Teachers

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Abstract

Starting from the assumption that current Romanian university students enrolled in teacher education programmes have directly or indirectly been immersed in technology for most of their schooling life, this paper aims at investigating these students' attitude towards using their ICT skills in their future teaching career. Drawing on recent reports and research covering the close link that has been or should be established between ICT and education in general and ICT and teacher education in particular, a small-scale questionnaire survey was conducted in order to check the validity of our assumption and, also to identify the factors that might enable or block prospective teachers to develop confidence in using ICT-based activities in their teaching. The subjects' answers reveal both the opportunities and the obstacles, leading us to the conclusion that more emphasis should be laid on the practical issues related to the integration of ICT into the learning-teaching-assessment strategies, as pedagogical and not technical support is badly needed.

Keywords: ICT, Teacher Education, prospective teachers, teaching

1 Introduction

Being interested in promoting general welfare, international organisations, such as UN and EU, have anticipated the immediate and long-term economic and social benefits that ICT integration in education might bring, as 'the world is experiencing a major shift from an economy and society based on mass production to one based on knowledge creation' (Kozma, 2011). These organizations' educational agendas have started to outline the importance of ICT and, consequently, frameworks and guidelines (UNESCO, 2008a; 2008b; 2008c) have been proposed and various studies and surveys have been conducted (EC, 2008; Enochsson and Rizza 2009; Rizza, 2011; EC, 2013) to serve as a possible reference point for countries all over the world, so that national governments could embark on developing ICT policies to be implemented in their educational systems. Nevertheless, no ICT policy suffices to bridge the gap between expectations and reality as far as ICT integration in education is concerned, and more efforts are needed at teacher, institution or system level. From this perspective, our small scale survey attempts to investigate Romanian prospective teachers' view on using ICT for instructional purposes, as we assume them to be *digital natives* (see Prensky, 2001) and hence more confident about using ICT than experienced teachers. In part one, we briefly outline the relationship between ICT and education, with special reference to the importance of ICT in both pre-service and in-service teacher education. Then in part two, our research is described in point of methodology and results, so that in the final part of our paper we could present the conclusions of our investigation and make some suggestions.

1 ICT and Teacher Education

Given the fact that technology is rapidly changing, people's access to information is constantly redefined and, therefore, education is in permanent quest of addressing ICT challenges and, ultimately, incorporating ICT benefits, thus attuning its strategies and techniques to digital age demands. There are many issues worth considering when approaching the links between ICT and education (such as the implications of ICT for teaching, learning and assessment; ICT integration in the curriculum; teachers' and students' ICT competence; ICT-based pedagogical practices etc.) and the extensive literature covering this topic, as well as the international and EU reports, definitely point to the importance ICT integration in education has acquired starting with the 1980s.

There is one recurrent theme emerging from research focusing on the impact of ICT on education, namely the obstacles or barriers that have to be overcome for successful integration. Researchers have performed detailed analyses and grouped or ranked obstacles or barriers according to various criteria (for example, Ertmer (1999) divides barriers into first-order and second-order ones, Pelgrum (2001) labelled obstacles as material and non-material, and Becta (2004) refers to school-level barriers and teacher-level barriers). No matter the criterion selected for classification, the major obstacles to ICT use and integration are: lack of confidence, lack of resources and lack of access (Bingimlas, 2009). Diachronically, the weight of these obstacles have varied, and, without overlooking the importance of ICT equipment, recent reports (Enochsson and Rizza 2009; Rizza, 2011; UNESCO, 2011; EC, 2013) stress the need to invest in teacher professional development, especially as far as teachers' ICT-based teaching practices are concerned, because it is necessary to increase confidence in their digital competence and to raise awareness as to the positive impact ITC could have on teaching and learning. Therefore any ICT policy should cover both initial and in-service teacher professional development, so that, ideally, learners would be provided with similar opportunities.

As for in-service teacher education, according to data provided by these reports, the number of teachers that have acquired technological skills as part of their ICT in-service training has considerably increased in the past decade, being directly influenced each country's policy regarding in-service teacher professional development. As far as Romania is concerned, Romanian teachers have been encouraged to attend ICT courses and, thus, to acquire digital skills as part of their in-service training. According to Noveanu and Potolea (2008), about 62% of Romanian teachers were trained in ICT use, and data from 2013 EC survey indicate similar values (65%), outlining that it is compulsory for Romanian teachers to participate in ICT training. Nevertheless, Romanian teachers still lack pedagogical skills and vision to integrate ICT in teaching, in order to support the learning process (Noveanu and Potolea, 2008). This may be partially due to the fact that these in-service training programmes focus less on the pedagogical aspects of using ICT in the teaching process (Noveanu and Potolea, 2008). Moreover, sometimes, attending ICT courses is mere formality (Popa and Bucur, 2012; Chisalita 2011), Romanian teachers being interested in getting the assessment score badly-needed for career-advancement and salary increases, and not in becoming digitally supportive teachers.

ICT has also had a great impact on pre-service teacher education. Great focus has been placed on preparing prospective teachers to adequately and effectively use technology in their future classrooms, as this may be the means to achieve high quality education. Moreover, since, at present, exposure to digital devices is quite different from the past and it starts from an early age, individuals being commonly divided into *digital natives* and *digital immigrants* (Prensky, 2001), initial teacher education programmes are supposed to provide prospective teachers with the pedagogical skills, competencies and experiences that could help them understand how ICT can be used to teach content in rich and meaningful ways (Bullock, 2004, in Goktas, Ildirim and Ildirim, 2009; Keating and Evans, 2001, in Goktas, Ildirim and Ildirim, 2009). Thus, prospective teachers might become better trained to overcome the barriers and more knowledgeable of the enablers that could smoothen the path towards ICT integration into their future teaching activity.

But matching policy with practice is difficult to achieve. According to Bétrancourt (2007, in Enochsson and Rizza, 2009), no correlation can be established between student teachers' technological competencies and their pedagogical use of ICT, because, even if their digital skills have constantly improved, the pedagogical use of ICT in classrooms remains constant. Going along the same lines, the 2013 EC survey concludes that incoming teachers have not been sufficiently trained in the pedagogical use of ICT, although ICT training is included in initial teacher education in over half of EU countries. So, even if prospective teachers are skilled and competent in using technology, this knowledge does not simply transfer to teaching practices. Therefore, prospective teachers should be given the possibility to see and experience pedagogical integration of ICT in the classroom during internship, and teacher trainers' and mentors' technological skills need improvement (Enochsson and Rizza, 2009).

As for Romania, according to the standards put forth by ARACIS (The Romanian Agency for Quality Assurance in Higher Education), complying with educational regulations in force, initial teacher education programmes comprise compulsory ICT-related courses as part of the core-curriculum, such as Information and Communication Technologies and Computer-Based Instruction, and, possibly, elective ICT-related courses, if the university department organising the programme devised and endorsed them. In addition to these, prospective teachers might be further indirectly exposed to ICT by means of other courses and seminars, if digital tools were actively employed during instruction, or during their compulsory internship periods, if their mentors resorted to this type of teaching methods. Consequently, assuming that their digital knowledge, as well as skills, are superior to their more experienced colleagues', our investigation is aimed at Romanian prospective teachers' readiness to use ICT in their teaching, more exactly at identifying those key-enablers that could facilitate ICT integration in their future instructional activity.

1 Research

.1 Methodology

The survey was conducted at University of Ploiesti (UPG), in April 2013 and included a sample of 100 3rd year Bachelor's Degree students, from different specialisations: Philology (40), Economics (30), Computer Science (15), Math (10) and Administrative Sciences (5). They enrolled in the teacher education programme offered by the Teacher Education Department in UPG in 2010, as completion of such a programme is compulsory for those who want to become teachers in Romanian primary and lower-secondary education, according to current regulations (Education Act of 1995, Act 288/2004). The number of Philology students who choose the TED programme is bigger because they are qualified to teach basic disciplines in the curriculum (e.g. Romanian, foreign languages) and, consequently, there are more positions available for them, upon graduation, in the Romanian educational system. The sample is 73% made up of females and 29% males, the proportion being similar to the situation at national and even European level, according to data provided by Eurydice and OECD. 54% are from the urban area and 46% from the rural area. 96% of the subjects surveyed are between 21 and 24 years old, which is typical for Bachelor's Degree students. The questionnaire included 15 specific items, structured according to the objectives of our research: (1) assessing respondents' digital competence (their first personal or school-related encounter with a computer; disciplines in the curriculum that helped them improve their digital skills; indication of certificates attesting their digital skills; daily digital routine; which computer and internet activities they could perform and for what purpose) – multiple choice questions; (2) identifying respondents' attitudes, confidence and beliefs toward technology – the participants were asked to rate their degree of agreement on a scale of 1-3 with 1 being 'disagree', 2 'neutral' and 3 being 'agree'; (3) investigating respondents' opinion on ICT integration in teaching (self-assessing their ability to transfer their knowledge to teaching practices; scrutinizing their exposure to ICT-based teaching and learning) – two open-ended questions.

.2 Findings and Discussion

In point of gender and residence variables, the analysis of the data shows a high degree of homogeneity in subjects' answers. As for the specialisation and age variables, there are some small differences, so explanations will be provided.

As far as the first objective of our questionnaire survey is concerned – our subjects' digital competence, we focused mainly on the role teachers and disciplines in the curriculum had in providing our subjects with the basic technological knowledge and skills, and then in developing them. 30% of our subjects declared that they first laid their eyes on a computer at school, 63% at home and 7% in other situations, and the lack of computer equipment in Romanian schools a decade ago could very well explain these findings.

According to current Romanian curricular provisions for primary and secondary education (although Romanian Education Act of 2011 states that "ICT is an elective subject for students in grades 1-4 and a compulsory subject for lower and upper-secondary education', so far no measures have been taken to enforce these new provisions), at present, ICT is a compulsory subject only for those students attending ICT-specialised high-schools, and, for primary, lower-secondary and the rest of upper-secondary education, ICT is an elective subject, part of the school-based curriculum. The results of our investigation (28% of the subjects stated that they had a certified teacher guiding them to use a computer at primary level, 48% at lower-secondary level, 15% at upper-secondary level, and 8% in other situations – parent tutoring, children club, computer course, university, internet cafe etc.) revealed that most schools included ICT as an elective subject sooner or later, and, thus, students had the possibility to acquire digital skills at school (only 4% of our subjects, aged between 46-56, did not have this possibility). Moreover, 86% of the students that participated in the survey had a certificate assessing their digital skills, awarded at the end of their upper-secondary education, according to regulations in force, so the system acknowledges the importance of certifying these skills for graduates' future immersion in the job market.

As for the other disciplines in the curriculum before higher education that helped our subjects develop their ICT skills, two students mentioned Technological Education, one student – Math, one student – Romanian, all during lower-secondary education. Therefore, one could infer that teachers, who do not teach ICT-related disciplines, are not interested in developing students' digital skills by integrating ICT in their teaching and our investigation indicates a similar situation at university level. Apart from the university students enrolled in Computer Science, Math and Economics, who had many specialized disciplines in the curriculum which helped them improve their digital skills, the students in Philology and Administrative Sciences had few chances to develop these skills during university – 9% mentioned developing their digital skills by means of fulfilling some of their university assignments, mostly PowerPoint presentations. All the subjects in our sample attended Computer-Based Instruction, a mandatory discipline of the Teacher Education Department Curriculum, and this is how the Philology and Administrative Sciences students became acquainted with, and possibly more knowledgeable of the integration of ICT in teaching.

According to the answers provided, all our subjects own a personal computer, using it for various activities (learning, finding necessary information, socializing, relaxing etc.), and the time they spend in front of a computer every day varies between more than 4 hours (26%) and none

(1%). The rest of the subjects use the computer for 3-4 hours a day – 18%, 2-3 hours a day – 25%, 1-2 hours a day – 21% and less than one hour – 9%. The internet plays an important part in their daily computer-related activity, the time spent online (more than half of the time dedicated to computer activities is spent on the internet by three quarters of our respondents) being divided into: searching for academic resources (56%), socialising (28%), downloading (9%), searching for practical information (3%), playing online games (2%), online shopping (1%) and online chatting (1%). Being born and raised in the digital era, our subjects' daily exposure to computers has become routine.

The second objective of our research was to survey our subjects' beliefs, confidence and attitude towards technology. The respondents express strong positive beliefs about technology (82% of our participants agree that 'computers are reliable', 81% consider that technology could help them teach better, 57% believe that technology could help students learn better, and only 33% are worried that computers and related technologies will isolate students from one another) and they have a high to moderate level of confidence in their ability to use technology (89% agree with the statement 'I know how to use a computer', 66% are confident in using technology to teach, 51% can solve most of their problems when their computer doesn't work and only 45% use technology in their learning). Regarding their attitude towards technology, 54% are interested in computers and related technologies, 58% are interested in learning new technologies and 83% of our subjects declare that they are interested in learning technologies that will help their teaching in the future, thus exhibiting a favourable attitude towards integrating technology in teaching that will help them become capable, confident and willing teachers.

The final part of our investigation comprised two open questions that focused on our respondents' opinion to integrating ICT in teaching. Our subjects provided a wide range of answers for the first question ('*Taking into account your own experience, which are the positive aspects of integrating technology in teaching and learning?*') and it is worth mentioning here a few of the aspects they outlined: (1) technology facilitates learning, by making it attractive; thus students' motivation and interest increase, the teaching-learning process becoming more dynamic and interactive; (2) by means of technology, free up-to-date information is rapidly transmitted; (3) both teacher and student's tasks are easier to accomplish due to technology; (4) by means of audio-visual support provided by technology, students' comprehension enhances; (5) technology helps students become tidy and efficient; (6) students' continuous or repeated exposure to technology helps them improve their digital skills, which is essential considering the importance of technology in any field of activity; (7) technology facilitates socialisation, develops communication skills, thus improving the student-teacher relationship; (8) by means of technology students' experience is enriched, as traditional methods are blended with modern ones; (9) technology develops students' creativity; (10) by using technology you can learn by yourself and you can get help from anywhere in the world. Even if our respondents were not asked to point to any negative aspects related to integrating ICT in teaching, they mentioned a few ('it's tiresome, as, for the teacher, it means managing an extra workload'; 'the large amount of information available by means of technology is not always valuable'; 'if teachers lack the ability to give their students the proper guidance, then technology could become useless'; 'excessively relying on technology during teaching could result in reduced benefits'), thus proving that they are also very much aware of the disadvantages that ICT integration could involve.

The answers to the second question *('How should technology be used in Romanian primary and secondary education?'*) helped us draw a more exact picture of our respondents' readiness to integrate ICT in their teaching. Although they expressed strong positive beliefs about technology in the second part of the questionnaire, now our subjects' answers express moderation ('a rational balance should be kept between technology and traditional ways of teaching and learning'; 'only certain disciplines should benefit from ICT integration, because students already spend a lot of their free time immersed in technology'), because, based on their experience, technology can be used ineffectively ('students purposelessly navigate the internet waiting for the bell to ring'; 'technology is used because it is fashionable, as a means to an end – teachers are not able to capitalize on potential benefits'; 'with certain age groups, especially primary-school students, technology could be distracting, and the teaching-learning process might be seriously affected'). Moreover, on condition that the badly needed equipment is provided (tablets, laptops, projectors, internet access etc.), our survey participants outline the important role that technology could play as teaching-learning facilitator and, what is more, as teaching-learning consolidator: 'technology has the power to broaden students' horizons by making it easier to accomplish educational goals' (female student in Computer Science, aged 22).

1 Conclusions

Acknowledging the limits of our paper (small number of subjects – 100; only one university – UPG) and hoping that by means of future research we will widen the scope of our investigation (more subjects from various Romanian universities), the findings provided by our survey indicate that current Romanian prospective teachers have generally acquired substantial ICT skills so far, being equipped with the necessary knowledge, skills and confidence to cope with the digital age demands and to deal with the material obstacles that could prevent them from successfully integrate ICT in their teaching. Also, Romanian prospective teachers are very much in favour of using ICT in teaching, but they lack exposure to ICT use in teaching, as the Romanian curriculum framework for primary and secondary education does not yet comprise ICT as compulsory discipline, but with several exceptions, and only few of their educators have actively employed technology in teaching, even if most of them have attended ICT training courses, as part of their compulsory in-service professional development.

Therefore, as a possibly indirect conclusion of our research, pedagogical models are badly needed for Romanian prospective teachers. Most of our respondents are digitally confident prospective teachers and they could become digitally supportive teachers (EC, 2013), if technology were used as a pedagogical tool for all the disciplines in the curriculum on a more frequent basis and more effectively than it is used now. Romanian prospective teachers' digital knowledge will not simply transfer to teaching practices, unless their educators create more meaningful experiences, easy for the prospective teachers to imitate and rely on when trying to integrate ICT in their teaching. Accordingly, guides comprising practical examples for devising ICT-based activities, organised around curricular areas, might prove beneficial for current Romanian educators, who will be able to resort to a much-needed reference point whenever necessary and thus provide students with valuable experience on which prospective teachers might build up their ICT-based teaching skills. Moreover, both pre-service and in-service teacher education programmes in Romania might facilitate the effective integration and use of ICT for instructional purposes, if these programmes explored the pedagogical rationale of ICT use, possibly prompted by national strategies and curricula that highlight the role of ICT in teaching and learning.

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Self-directed learning in online environments

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Abstract

Self-directed learning (SDL) has become one of the primary aims of education in the last few decades. Recent research highlighted the importance of self-directed learning skills not only for traditional learning situations but also for online learning environments. The study aims to validate the successful online learner portrait, having as starting point the findings that successful online learners are those who exhibit self-directed learning skills. The purpose of this paper is to introduce recent research in the field, highlighting the importance of SDL in online learning contexts. Implications for future research and practice are also discussed. Recent research indicates that students need to have a high level of self-direction to succeed in online learning environment. Online learning has a direct impact on self-directed learning because it facilitates facilitated the access to information resources and to online expertise. The study provides valuable information to online course providers and teachers in order to support the development of self-directed learners aiming to achieve success in their online courses.

Keywords: Self-directed learning, online learning, successful online learner

1. Introduction

Self-directed learning (SDL) has become one of the primary aims of education in the last few decades. All individuals are capable of self-directed learning but the degree of development varies due to their individual differences. Recent research highlighted the importance of self-directed learning skills not only for traditional learning situations but also for online learning environments. Hiemstra (1994) presents several features of self-directed learning:

- the learner is empowered to take increasingly more responsibility for various decisions associated with the learning endeavor;
- self-direction is best viewed as a continuum that exists to some degree in every person and learning situation;
- self-direction include a variety of learning activities ranging from participation in study groups, online learning, and reflective writing activities;
- self-directed learning include also learning transfer;
- the role of the teacher includes activities such as dialogue with learners, securing resources, evaluating outcomes, and promoting critical thinking;
- self-directed learning refers not only to the traditional learning programs but also, to the non-traditional courses.

Research on self-directed learning focuses on several aspects:

- the feasibility of self-directed learning meeting job-related training needs in industry;
- understanding the role of technology in self-directed learning (Brockett and Hiemstra, 1991);

- enhancing self-directed learning by better understanding environmental factors (Hiemstra, 1994).

This study aims to validate the successful online learner portrait, having as starting point the findings that successful online learners are those who exhibit self-directed learning skills. The purpose of this paper is to introduce recent research in the field, highlighting the importance of SDL in online learning contexts.

2. Self-directed learning – definitions and new trends

Self-directed learning (SDL) has become one of the primary aims of education in the last few decades. Self-directed learning has its origins in adult learning, being defined as a process in which individuals take the initiative, with or without help from others, diagnose their learning needs, formulate their learning goals, identify human and material resources for learning, choose appropriate learning strategies and evaluate their learning outcomes (Knowles, 1975).

Self-directed learning is considered both a process and a personality trait. As a process, Hammond and Collins (1991) proposed a model which includes the following steps: building a cooperative learning climate; analyzing the situation; generating a competency profile; conducting a diagnostic self-assessment of learning needs; drafting learning agreements; self-management of learning; reflection and learning; evaluation and validation of learning; and coordinating critical SDL. Other researchers have framed SDL from a psychological point of view, emphasizing self-directed learning as a personality trait (Brockett and Hiemstra, 1991; Guglielmino, Long, and Hiemstra, 2004). From this perspective, the self-directed learner is motivated to assume personal responsibility and collaborative control of the cognitive (self-monitoring) and contextual (self-management) processes in constructing and confirming meaningful and worthwhile learning outcomes (Garrison, 1997). Self-directed learning as a personality trait cannot be observed directly, but the tendency to self-directedness has been associated with academic achievement, self-efficacy, conscientiousness, epistemological beliefs, and beliefs about internal control (Lounsbury et al., 2009). A third perspective takes into account the learning context, self-directed learning being context bound. From this perspective, self-direction is different in different context areas (Candy, 1991).

3. Self-directed learning and online environments

Online learning has a direct impact on self-directed learning because it facilitates the access to information resources and to online expertise. Higher education is occurring in a variety of contexts, ranging from face-to-face classrooms to virtual classrooms, this is why self-directed learning is an important feature of successful students. Technology provides improved access, offers flexibility, and answers to the educational demands of the information age. Online learning requires new perspectives in course design and student/teacher roles. An important issue remains: What elements in online learning can foster the principles of learner control and self-direction?

In the last decades, there is an increasing trend of online learning in higher education. Recent research in the field reports an important impact of self-directed learning in these contexts, self-directed learning skills assisting the learner with the learning process in online contexts (Hartley and Bendixen, 2001).

Online learning requires students a degree of self-direction in order to obtain academic success. Previous research correlates student computer skills and interactive skills to learner autonomy, learner autonomy being considered an important predictor for success in online learning (Owston, 1997).

4. Models and principles of self-directed learning in online environments

Studies have indicated that a learner can improve his level of self-direction by experiencing self-directed learning. Training program which can improve the self-direction skills were implemented not only in the traditional learning contexts but also in online learning contexts. Although, regarding the relation between self-directed learning and academic performances, there are no consistent findings. Some researchers report that students' self-directed learning abilities do not relate to their academic performances (Doherty, 2000), others report significantly positive relationship between students' self-directed learning abilities and academic performances (Corbeil, 2003).

The online learning context impacts self-directed learners personal attributes of resource use, strategy use, and motivation. One of the most relevant models for online learning from the self-directed learning perspective is the Song and Hill (2007), Online Self-Directed Learning model. The model incorporates self-directed learning as a personal attribute, as a learning process. The model also includes the learning context, indicating the impact of environmental factors on self-directed learning (Table 1).

	Self-directed learning		Learning context		
Input	Personal attributes	Autonomous process	Design	Support	Outcomes
Prior knowledge	Resource use	Planning	Resources	Instructor feedback	Learning
	Strategy use	Monitoring	Structure	Peer collaboration	Satisfaction
	Motivation	Evaluating	Nature of tasks		

Table1. The Song and Hill (2007) Online Self-Directed Learning model

Prior knowledge and prior experience are considered the learning input. This input, the context and the personal attributes are the conditions that accompany the learning process. Personal attributes include students' motivations, the use of resources, cognitive strategies and intrinsic motivation. The personal attributes are characteristics students bring to the online learning context. The autonomous learning process refers to planning, monitoring and evaluating, student autonomy being considered not only as a continuum (Candy, 1991) but also as a cyclic process. Learning context focuses on environmental factors and how those factors impact the level of self-direction expected from the student. Design elements include the resources, structure and nature of the tasks in the learning context. The support component includes constructive and informative feedback from the instructor or peer collaboration and communication (Oswalt, 2003; Song and Hill, 2007).

The unlimited amount of information available on the internet and the gathering of good quality information resources can be a challenge to students. Students need to actively explore various learning resources in the online learning context. Thus, successful learning in every learning environment involves the use of effective learning strategies and the implications of the personal learning attributes. Motivation also contributes to the learning process in online environments, online students using enhanced motivational strategies to avoid procrastination (Song and Hill 2007). Song and Hill (2007) explain that between the personal attributes and the learning process is an interactive relationship. In order to take control of the planning, monitoring, and evaluating learning processes, students rely on their use of strategies and resources, and their ability to motivate themselves. Their involvement in the learning processes can impact their level of self-direction and autonomy.

In order to promote self-directed learning, online learning requires principles such as:

- online learning must be user-directed and supportive;
- sufficiently open-ended and complex;
- provide means for significant modification, extension, and evolution by users;

- support a range of expertise, because such systems will be employed over long periods of time by their users and must be able to accommodate users at progressively different levels of expertise;
- promote collaboration (Fischer and Scharff, 1998).

5. Conclusion

Recent research focused on the implications of online learning on self-directed learning. Online learning support self-direction by increasing the learner control and providing mechanisms for learners to determine the pertinent information. Other advantages are the possibility to learn at your own speed, to track your personal progress, to test personal learning efforts (Hiemstra, 2006). Integrating self-directed learning in online courses requires the following steps: prepare a set of outcomes that encapsulates the course, expand the options for learning, teach the skills and processes that students need, negotiate their learning proposals with them and launch them into their projects, monitor their progress, and review with them their assessments of what they have achieved (Gibbons, 2002).

As online distance learning has grown, so too has interest in self-regulated learning. Using the conceptual model presented in this article, online teachers are encouraged to consider and explicitly address their students' academic motivation, achievement goals, and self-direction as they strive to provide effective and engaging online instruction. Online learners work in a learner-controlled environment and have more choices than traditional learners. Online students plan, direct, and, when necessary, modify the ways they approach learning contents. Absence of self-direction is strongly linked to the absence of online academic success (Hodges, 2005). Integrating self-directed learning activities into course work and an emphasis on process oriented feedback can provide self-regulation support.

Although self-directed learning in online environments is discussed in many recent researches, there still remains much needed research regarding the measurement instruments for the self-directed learning skills in online environments, gender differences regarding the self-direction, the relationship between self-direction an academic achievement, the teacher role in the learning process. The role of self-direction kills in the online learning environment has not received the same attention as it does in the traditional face-to-face environment.

Self-directed learning skills play an important role in learning in the online environment. Students lacking self-directed learning skills may misconstrue the autonomy of the online learning environment and, as a result, may not accomplish learning tasks they are expected in online courses (Barnard, Lan, To, Paton, and Lai, 2009).

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Textbook and digital course: what make differences?

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Abstract

This article provides an overview of the course "Methodology of educational software", designed and elaborated with Course Builder, provided by Google. The aim of the article is to compare the requirements of the Metasystems Learning Design in course and textbook use and development. The issues, controversies and problems in Instruction Design are analysed. The article is focused on understanding the new learning ideal requirements for the global learning environment. It is concluded that Course Builder is an effective tool for design and development of the university courses, but needs some improvements.

Keywords: course, textbook, digital textbook, digital textbook, digital learning environment, Course Builder.

1 Introduction

According to join definition the textbook is a book used as a standard work for the study of a particular subject, a book containing a presentation of the principles of a subject, a book used by students as a standard work for a particular branch of study or a manual of instruction in any branch of study. Traditionally, the textbook is produced according to the demands of educational institutions.

The course is a unit of teaching that typically lasts one academic term, which is led by one or more instructors (teachers or professors), and has a fixed roster of students. It usually describes an individual subject taken. Students may receive a grade, academic credit, diploma or certificate of attendance after completion of the course requirements. The course requires a monographic textbook or other course material. Although most textbooks and course material are only published in printed format, many are now available online.

Each of the courses engage students in active learning environment, that, according to Midoro, (2005, p. 42), can be global and local, real and virtual. This is a place or a community in which a number of activities are occurring with the purpose of supporting learning and those actors can draw upon a number of resources' when doing so. The learning environment in online education is designed for the self-regulated learning students, because provides the video material, forum of discussions, peer review activities and more …, according to schedule.

In our Digital Age both course and textbook can be taken online. There are many tools used for using, developing and dissemination the digital versions of textbook and course. One of those is Course Builder. This is the experimental project in online education developed by Google. Based on information, placed as a wikibook, the Course Builder contains software and instructions to present the course material through lessons, student activities and assessments and to create a course community and to evaluate the effectiveness of running course.

The aim of this article is to compare the Course Builder requirements according to MetaSystems Learning Design principles and its norms of realization. The aim is achieved through the following objectives:

- to describe MetaSystems Learning Design (MLD) principles and phases;
- to identify issues with MetaSystems Learning Design and Course Builder;
- to propose a model for Course Builder that should archive MLD, including technical requirements.

2. MetaSystems Learning Design

The Metasystems Learning Design is an approach based on the following principles: “the principle of self-regulation (the automatic regulation of learning process through activities of metacognition using didactical and psychological methods, cybernetics techniques and management systems), principles of personalization (the individualization of learning objects through increasing formation of the individuals as a self and member of global learning environment); principles of feedback diversity (electronic educational content needs to be evaluated through immediate and delayed feedback); principles of clarity (the formation of structural skeleton content with powerful interconnected concepts); principle of dynamics and flexibility (the learner active inclusion in elaboration the ET content in order to provide the competence development skills) and principle of ergonomics (computer based learning and computer based assessment is guided by ergonomic interfaces and ergonomic places of work)” (Railean, 2012, p. 244).

The MLD principles are archived by specific norms. One of those requires digital courses will be developed according to three main phases:

- Design
- Production
- Validation.

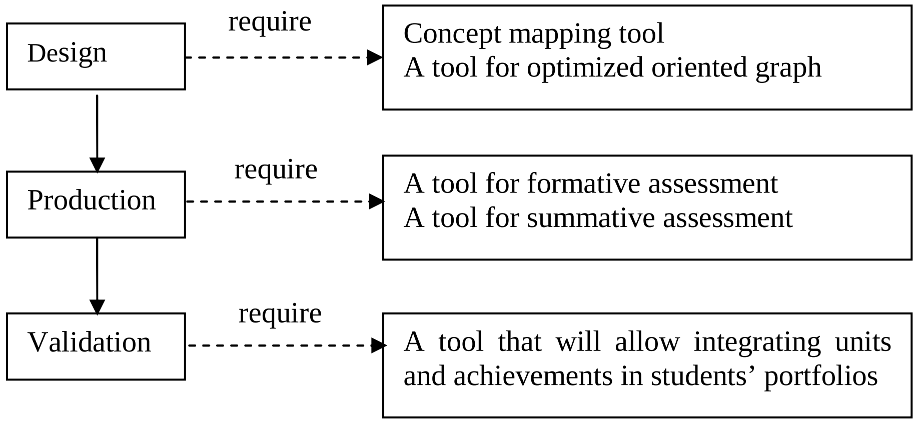
On the first phase should be identified the main design issue through analysing the learning outcomes in concordance with pedagogical resources and tools. On the base on established issue is established the long-term or/and short-term aim and objectives (focused on forming/developing the integrated structure of competence). Then, is designed the structure of textbook (course) using the adjacency matrix or/and its optimized oriented graph technique. This allows elaborating the table of content and designing the structure of modules, chapters, paragraphs etc. On the base on design model is elaborated the most effective plan for realization (with learning strategy, methods, procedures and techniques).

The phase “production” requires passing two main stages: a) “content” and b) “assessment”. At the first stage has been elaborating the *instruction framework* (full and short versions) as well as graphic, animation, audio, video content etc. One of the base requirements is to test the user interfaces of course before it will be used for learning. At the second stage is important to identify structure and elaborate tasks for cognitive activities as well as self-assessment, and peer and group assessment. At this stage is important to follow technical requirements.

The phase “Validation” requires evaluating the course based on tutorial-tryouts method (formative assessment). This method consists on analysing of one course unit efficiency in the learning environment controlled by the teacher. At the end of teaching process the students complete a survey. On the base of obtained results could be updated the course content. The summative assessment of course efficiency is based on analysing the students’ performance based on psychological or/and pedagogical tests.

3 One possible model for course based on MLD with Course Builder

According to MLD approach it is important to follow three main phases. The proposed model compares the MLD approach and Course Builder possibilities (version 1.5.1).



Based on MLD approach digital course and digital version of scholar monograph differ in one significant aspect:

Table: *Differences between digital course and textbook (monographic)*

	Digital course	Textbook (monographic)
Platform	eLearning or/and mLearning platform, including Open edX Digital teaching platform	-
Registration	Require to sign as a administrator or as a user	-
Student progress	Analytic	-
Structure	Schedule	Table of content
Content	Presentation and assessment (with learning tool)	Text and assessment
Activity	With immediate/delayed feedback	-

4 Technical requirements

The course, elaborated with Course Builder, can be hosted on PC or on the Google webservers. Google webservers offer a limited amount of space enough to host a course for ~ 50 students. Otherwise, for more flexibility the course should be hosted on PC or Laptop using the server application provided by Course Builder.

If the decision is to host and run the server application from the PC, the technical requirements are the following: Dual Core CPU with 2.0 GHz for each core or more, RAM 4 GB, space on HDD 10 GB, stable Internet connection with average speed above 10 MB/s. Software requirements for the host computer: any update operating system Ubuntu 10 or above; Mac OS 10.x or above Windows XP, Vista, Seven, 8; Google AppEngine, Python 2.7.x; any updated (Opera 15 or above, Firefox 21 or above, Internet Explorer 8 or above, Safari 5 or above; latest Flash Player 11, Google Account, Google Drive, Google Docs (optional). The users that will design, develop or evaluate should have a PC or Laptop with same technical requirements.

However, the students with tablet pc/smartphone need to install 3G or Wi-Fi adapter with a stable Internet connection with average speed above 5 MB/s, RAM 256 or more, CPU 600 MHz and above, Operating System: Android 2.3.x or above, Windows RT, iOS 4 or above, Ubuntu Mobile, any updated mobile browser Firefox, Opera, Safari etc., Flash Plugin for mobile devices and Google Drive.

After server application run, the Course Developer should install the Google Course Builder. There are three main steps: 1) downloading and installation the Python (http://python. org/download); 2) downloading and installation the Google App Engine; 3) downloading and installation on PC the Google Drive. The Google Course Builder installation process differs according to operating system installed on PC or Laptop.

For *Linux* users (or other POSIX-compliant system): after downloading the .zip file, go to the directory where you want to install Google App Engine (GAE). When you unzip the archive that contains the installation files of GAE, it creates a subdirectory named google_appengine. Add this directory to your shell's path so that it can find the command-line tools when you need them.

For *Windows 7* users: run the downloaded installer .msi for GAE and follow all on-screen instructions. On the screen that asks for the destination folder, be sure that product path to user PATH is checked. This is required for the command-line tools to work properly. Once completed, you should find the GAE Launcher icon on your desktop or be able to find it via Start -> Programs.

For *Mac* users: open the downloaded .dmg file and drag the GAE icon into the Applications folder. Optionally, open the Applications folder and drag the GAE icon to your Dock to start the GAE Launcher more conveniently. Putting GAE in the Applications folder also installs the command-line tools.

For the course materials development, the author will use the standard instruments (MS Paint, Notepad, WordPad, MovieMaker etc.) as well as freeware software. For example for *video editing* (AVIDemux, AviTricks, Jahshaka, t@b ZS4); for *graphic editing* (Gimp, XnView, Photoscape, RawTherapee, Pencil; *for text* (Google Docs, OpenOffice); for *audio editing* (Audacity). If the course will include a reference to monographic textbook that will run on mobile devices, in development of textbook will be used EPUB editors and converters (Colibri, ePUB to GO, Sigil, eCub Creator etc.).

5 Conclusion and future research

There are many facets to design, elaborate and validate digital courses according to MLD approach. Much is driven by the purpose of the lesson and assessment. However, there is need for same improvements: concept mapping tool, a tool for optimized oriented graph; a tool for formative assessment, including design of frames and tasks (items) generation for math, science and technology; a tool for summative assessment, including the possibility to generate students' portfolios.

Research is needed across interdisciplinary areas to fully realize the potential of the Course Builder according to MLD principles and theirs norms of application. This article aims to capture the MLD approach with Course Builder.

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e -Skills for Applied Sciences Labs

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Abstract

A non-classical approach of applied sciences labs (physics, chemistry, and engineering) in high schools and universities, involving e-skills for the 21st century, based on market demands, are presented and discussed. Students should have access to both classical and modern type labs, allowing them to choose labs subjects according to their interests in career. Taking into account that each lab has its technical limits, and cannot offer all knowledge and skills asked by labor market, it should offer its own e-labs, but also other e-labs running in other labs. Authors propose a set of basic rules for preparing and running e-labs: how to record labs, process video and pictures files, measure and process data, share labs on internet. Some basic accessible software (Windows Movie Maker, Paint, Screen Calipers, MathCAD) are discussed.

Keywords: e-skills, science labs, Windows, MathCAD

1. Introduction

According to European Comission (Richier, 2010) e-Skills definition refers to:

e1) ICT practitioner skills (capabilities required for researching, developing, designing, strategic planning, managing, producing, consulting, marketing, selling, integrating, installing, administering, maintaining, supporting and servicing ICT systems;

e2) ICT user skills (capabilities required for the effective application of ICT systems and devices by the individual; ICT users apply systems as tools in support of their own work; user skills cover the use of common software tools and of specialised tools supporting business functions within industry; at the general level, they cover “digital literacy”);

e3) e-Business skills (capabilities needed to exploit opportunities provided by ICT, notably the Internet; to ensure more efficient and effective performance of different types of organisations; to explore possibilities for new ways of conducting business/administrative and organizational processes; and/or to establish new businesses.

EU Communication on e-Skills adopted by the European Commission on 7 September 2007 proposed a long-term e-skills agenda and five action lines at EU Level:

a1) Longer term cooperation (strengthening cooperation between public authorities and industry, academia, unions and associations through the promotion of multi-stakeholder partnerships and joint initiatives including monitoring supply and demand, anticipating change, adapting curricula, attracting foreign students and highly skilled ICT workers and promoting ICT education in a long-term basis;

a2) Human resources investment (ensuring sufficient public and private investments in human resources and e-skills and appropriate financial support and fiscal incentives as well as developing an e-competence framework and tools facilitating mobility, transparency of qualifications and credit transfer between formal, non-formal and industry ICT education);

a3) Attractiveness (promoting science, maths, ICT, role models, job profiles and career perspectives with a particular focus on young people; information campaigns are necessary to provide parents, teachers and pupils, notably girls, with an accurate understanding of opportunities arising from an ICT education and the pursuit of an ICT career);

a4) Employability and e-inclusion (developing digital literacy and e-competence actions tailored to the needs of the workforce both in the public and the private sector, with a particular emphasis on SMEs and also to the needs of the unemployed, elderly people, people with low education levels, people with disabilities and marginalized young people);

a5) Lifelong acquisition of e-skills (ensuring that workers can regularly update their e-skills and encouraging better and more user-centric ICT enhanced learning and training approaches (e-learning); good practices for the training of employees, with a particular emphasis on SMEs, using e-learning should be promoted together with successful solutions and business models.

Applied sciences labs are one of the best examples of activities addressing to the all three types of e-skills and fitting to all five action lines presented before. There is a high demand of labs created with ICT practitioners, for ICT users, on a free market with high opportunities provided by Internet. The present work is one of a series (Buioca, 2009, 2010) referring to a new type of science labs, based on real labs and Internet, better answering to the market demands and to the five action lines presented before.

2. e-Labs Based on Real Experiments

Physics and engineering sciences labs are remarkable by their strong informative and formative character, allowing students and experimenters to learn and fix new theoretical knowledge and practical skills. That is why, nowadays, the presence of the experimenter in the lab is considered mandatory, also conditioned by the classic way of running a lab activity.

A brief analysis of national and international lab offer reveals several trends, presented below.

t1) There is a strong trend to optimize the lab activity, by: reducing number of technical staff, decreasing the number of lab hours per discipline, increasing the number of students participating to a lab, increasing the number of parallel lab works. Under the circumstances, it is difficult to maintain the high informative and formative standard of such an activity, possible only by providing more detailed tutorials and increasing the amount of time for lab preparation and study.

t2) There is a very rich and diversified offer of so called e-labs on-line, that are mostly simulations of physical phenomena or engineering applications. Two major trends are to be found here: a) simulations using e-learning specialized platforms, in which modeling equations are not visible, but allowing users to input some data and see the results on the studied phenomenon; b) modeling/simulations using specialized software, allowing users to see the equations governing the studied phenomenon, input some data and see the effects.

t3) There is a poor offer of video files with front-records, cvasi-static, regarding experiments and lab works, in which the experimenter is presented in a large frame, from one recording angle, doing the experiment; the user can see and follow the experiment but cannot participate to or measure any physical parameter.

Each of these trends has their advantages and disadvantages. This work proposes a new approach, combining the advantages: possibility to conceive classic lab tutorials in electronic format, modeling and simulation of the studied phenomena using accessible software and use of labs video records from the view angle of the experimenter, allowing users to observe, measure and process experimental data as they were in the lab.

3. e-Skills for Video Records

Next basic principles for achieving video records were fallowed (Buioca, 2009).

v1) Video records are achieved from the view angle of experimenter, allowing users to follow the experiment as they were in the lab, replacing the experimenter.

v2) Experiments are performed by two experimenters, one experienced (doing the record), the other less experienced, as a usual student (doing the technical operations). The number of two experimenters is the optimal one, allowing discussions and collaboration in order to increase the experiment's quality.

v3) Both experimenters comment permanently the technical operations, measurement results, observations, providing audio information very useful to the user. This last one will be therefore able to better understand the technical operations, measurement results, and have his conclusions. The user can stop and play the record, read his results and compare with the ones obtained by the experimenters.

v4) The video file format depends on the desired measurements accuracy. Usual and accessible camcorders allow HD or Full HD records (up to 1980×1080 pixels, up to 60÷200 fps), giving good accuracy in determination of coordinates and time. Higher accuracy can be obtained by using more expensive camcorders, specialized software for image interpolation or by data processing.

v5) If offered on-line, for international users, the video record can be completed with some audio files or subtitles in different languages.

4. e-Skills for Video File Processing

The video file must be downloaded on a PC and processed, for reason of maximum accessibility, using typical Windows software (Windows Movie Maker – for download and processing video files, Windows Media Player – for playing, Paint – for still pictures processing).

You will find a lot of tutorials for Windows Movie Maker. Unfortunately, they are all written by IT specialists for general purpose. What we are presenting here are some tips coming from experience and useful for scientific purpose.

A typical Windows Movie Maker dialog box is shown in figure 1. One can see a typical Windows Office main menu (File, Edit, View, etc.) and a display frame with typical commands (Play, Stop, Frame by frame, Split the clip, Take a picture, Time counter).

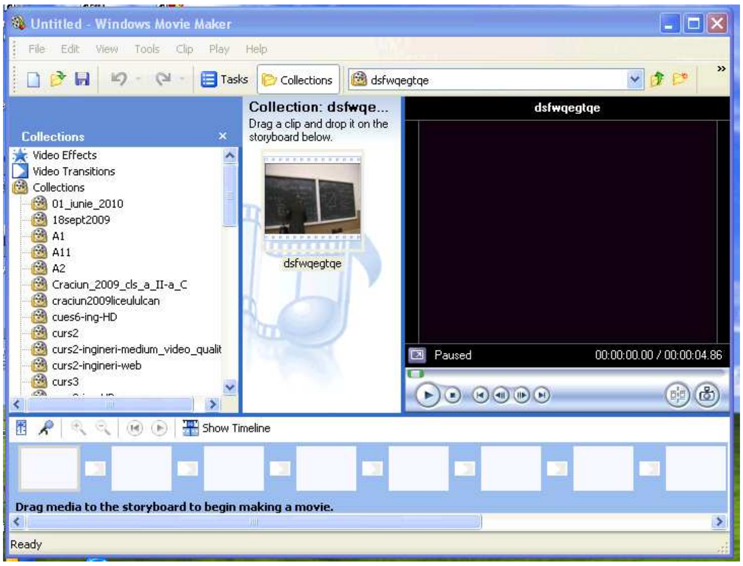

Figure 1. Movie Maker dialog box

Once you start your Windows Movie Maker program, you must first import your video file (click on File, then Import into Collections). Now you are ready to play your record.

Here are some tips for obtaining best accuracy measurements.

- You can Pause and then Split the clip, thus removing unnecessary actions in your clip.
- Then you can play again your record, using „Frame by frame" facility.
- Once you obtain a useful frame, push the „Take a picture" button. The picture will be available for further data processing, at the same display accuracy as the video file, allowing the obtaining of distances, angles and moments of time.
- You can read the frame's time below-right the displayed frame, taking into account that, actually, two superposed frames are displayed. For example, if you have 25 fps, the time step should be 0.04 seconds and what you get is 0.08 seconds. If you have objects moving, you will see the objects in different positions, corresponding to the two superposed frames, as shown in figure 2.

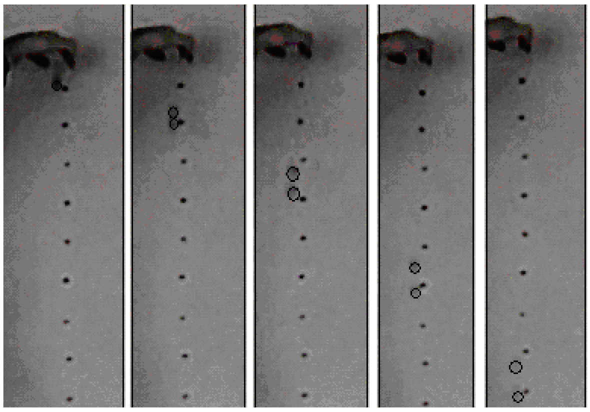

Figure 2. A free falling object at different moments;
columns correspond to moments from 0 to 0.40s, step 0.08s

- Save the final video file and open it again with Windows Media Player (or any other similar program). You will be able now to stop/pause/play the movie, measure/read your data for different frames, analyze your experiment, etc.
- You can now increase your measurements accuracy by open in Paint (or any other similar program) each saved picture, zoom it up to pixel level and measure/read again your data. Figure 3 shows an example.

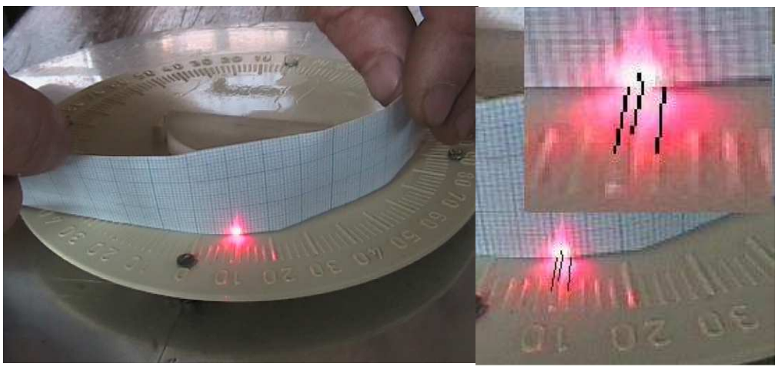

Figure 3. Measuring/reading data in an optics experiment, at different zooms;
while the initial reading is 10 ^{0},the final one is 10.8 ^{0} (zoom 400%)

- You can also increase your measurements accuracy by using a Screen Ruler or a Screen Caliper (for example, http://www.iconico.com/caliper/), as shown in figure 4. They both relate pixel dimension to distance between two points on your picture.

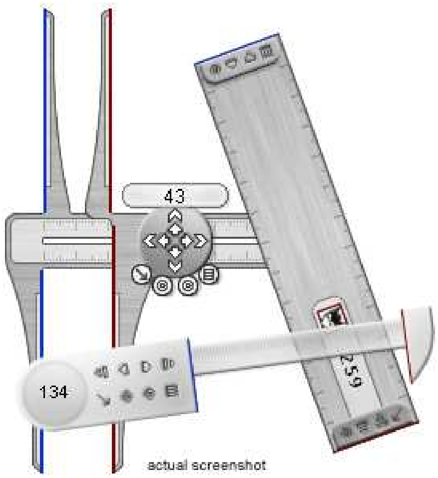

Figure 4. Screen Ruler and Screen Caliper

5. e-Skills for Data Processing

You can find a lot of programs for data processing, starting from the simple ones, like Microsoft Office Excel, to the advanced programming one, like Mathematica (http://www.wolfram.com/). We strongly recommend MathCAD (http://www.ptc.com) an user-friendly program with a simple programming language (very close to the mathematical language) accessible to both practitioners and users.

Although you can find very good tutorials for MathCAD, for science labs you don't need to know all the facilities offered by this program. Our experience shows that a minimum knowledge is required, as shown below, for a real situation of a uniformly accelerated linear motion described by the equation $x(t) = t^2 + 2t + 3$ (Buioca, 2010).

The MathCAD program for processing experimental data is presented below, with comments (text mode) in italics.

$$te := \begin{bmatrix} 0 \\ 1.1 \\ 2.1 \\ 2.9 \\ 4 \\ 5.1 \\ 6 \\ 6.9 \\ 8 \\ 9 \end{bmatrix} \qquad xe := \begin{bmatrix} 3 \\ 5.5 \\ 12 \\ 18 \\ 29 \\ 41 \\ 51 \\ 60 \\ 75 \\ 112 \end{bmatrix}$$

Two vectors te *and* xe *are defined and the experimental data, characterized by a relative errors under 10%, are introduced as vector elements.*

$t := 0, 1 .. 9$

A time row is defined, having values from 0 to 9 (seconds), with step 1 (second). These values can be considered those determined with perfect accuracy (0% relative errors).

$x(t) := t^2 + 2\cdot t + 3$

A function x(t) *is defined, giving the values (in meters) determined with perfect accuracy (0% relative errors).*

The typical data interpolation block, based on cubic spline interpolation, is:

$xs1 := cspline(te, xe)$
$xs2 := pspline(te, xe)$
$xs3 := lspline(te, xe)$
$m := slope(te, xe)$
$b := intercept(te, xe)$
$xregress := regress(te, xe, 2)$
$xloess := loess(te, xe, 1)$

$$F(z,u) := \begin{bmatrix} u_0 + u_1 \cdot z + u_2 \cdot z^2 \\ 1 \\ z \\ z^2 \end{bmatrix}$$

$$vg := \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$P := \mathrm{genfit}(te, xe, vg, F)$

$g(r) := F(r,P)_0$

$i := 0, 1..\ 9$

$r := 1, 1.1..\ 10$

The graphic is:

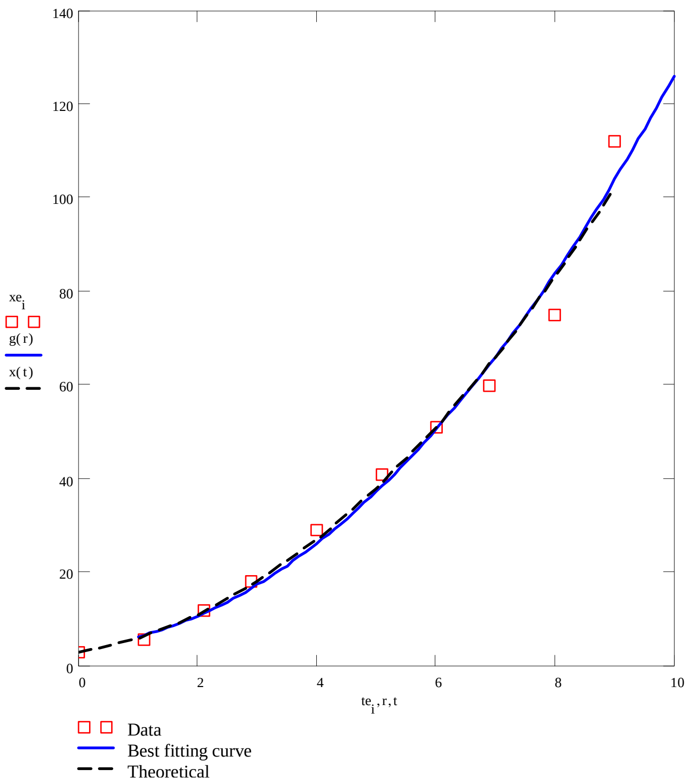

Figure 5. Typical graphic obtained by data processing with MathCAD

One can see that the best fitting curve (obtained by data interpolation) is very close to the theoretical one and clearly removes most of experimental data errors.

6. Conclusions

Basic e-skills required by modern applied sciences labs are discussed, based on our past years experience. Both practitioners and users should know how to record an experiment, process the video and picture files, measure/read data from files, and process data with specialized software. Our experiments with students from high school and university levels showed that these e-skills can be achieved in a dozen hours of lectures and seminary.

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Geometry – science and art

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Abstract

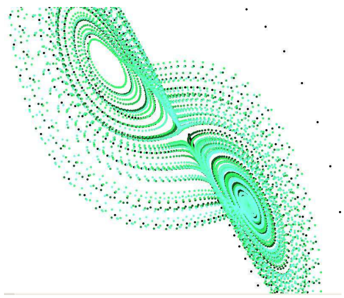
The paper presents some ways of using the new technologies to help the students understand classic geometry, as well as the bases of fractal geometry. As it is dedicated to the famous Romanian geometer Gheorghe Țițeica upon the anniversary of 140 years since his birth, the paper also presents a few of his results in classical geometry. The results are of high interest for the students and are presented by using new educational technologies.

Keywords: Fractal geometry, New educational technologies, Țițeica surface, Architectural process

„The scientific study of natural phenomena aims to take a mathematical form and this study is complete when the mathematical form has been found. Born in parallel with the Greek art, mathematics has kept in its internal fabric a certain affinity with art.”

Gheorghe Țițeica

Contents



1. Introduction

Lines or curves, planes or surfaces, symmetries and translations, scales or proportions, they are concepts that appear in both mathematics and the visual arts. Geometry can thus be considered a bridge between art and science.

2. The art of geometry vs. the geometry of art

Over time geometry has been considered as a paradigm of reason, having as tools abstraction, perfection, ordering, analysis. Moreover, through its clarity, elegance and brevity, geometry can be considered an art of reason.

Pure art, "cleaned" of previous constraints, especially religious ones, is exemplified in movements like constructivism, purism, cubism, expressionism, surrealism, deconstructionism. Geometric order governs here and everything relates to it.

Purists regard art from a psychological, scientific perspective. What impresses the individual at the most profound level must be the base of new art. Based on a generalization of certain results in experimental psychology, it was meant to found an art that will scientifically correspond to man's spiritual needs, the key to adaptation being the elementary geometric shapes: the circle or the sphere, a square or a cube, triangle or cone. The order which these embody is considered to be a human constant, a premise of emotion: "All plastic satisfactions result from the system of geometry" or "Man is a geometric animal" or "The shapes of simple geometry produce the purest effect on us. Thus we have physiological keyboard whose sensitive properties we know." (Le Corbusier). After the geometric order is enthroned, everything relates to it. Some art critics do not consider as sufficient a justification like "As with other architectural idols, the conclusion also fulfils the role of hypothesis, preceding the demonstration."

The strongest connection between geometry and art is observed in architecture. Geometry is a fundamental discipline for architecture because it allows a spatial representation of the ideas of the architect.

The fundamental principles of architecture were set out by Vitruvius in "The Ten Books of Architecture":

1. Architecture depends on Order, Arrangement, Eurythmy, Symmetry, Quality and Economics;
2. Order is selecting a standard module and building the whole starting from it;
3. Arranging is putting the parts in the appropriate place;
4. Eurythmy is the beauty and suitability of the parties together;
5. Symmetry is the relationship between the parties and between them and the whole;
6. Quality is the unified style;
7. Economy is the management of materials and construction.

More recently, in the late twentieth century, we see new attempts to revive the notion of "architecture". For example M. Drăgănescu introduced a new concise and general definition of the architecture of an object (1971): "The architecture of an object of any kind, can be defined as a triplet $<A_f,A_o,A_g>$ where: A_f is the functional architecture of the object (generally, of the external functions, but also of some internal functions if they have a special role); A_o represents the parts (or the main relevant parts) of the object; A_g is how the object is perceived by an external observer or by the object itself."

Based on the works of M. Drăgănescu, Gorun Manolescu [7] proposed a new hierarchy of the levels of an architecture by introducing two additional levels: the formative invariants and the physical, concrete structure:

a) A first structure, directly visible - *the physical structure;*
b) A second structure, more profound – *the organizational and functional structure;*
c) A third even more profound structure – *the structure of the formative invariants*.

What could mean *the structure of the formative invariants*? Obviously we think of the Erlangen program of Felix Klein (1872).

"*Formative invariants* contain 'in nuce' both the backbone of the future artifact and the associated dynamics (evolution), just as it happens with another *formative invariant*, this time used by Nature, namely the DNA. Furthermore, we believe that we are not wrong saying that similarly to how from primitive forms like 'the sphere with handles' and 'the sphere with Moebius bands' from the Topology applied to figures, through successive topological transformations derive other highly sophisticated shapes, in the same way, through successive transformations and detailing, from a (synthetic) structure of *formative invariants,* there can be generated other structures: functional-organizational and physical, in the case of any artefact or natural object (as *the formative invariants preserve themselves*). Finally, one can say that the sustainability and efficiency of the ultimate structure (the physical one) of a natural or artificial object depends on correctly intuiting the structure of the formative invariants."[7]

Symmetry, rhythm, harmony are specific to architecture in general, but their opposites - asymmetry, arrhythmia, dissonance – are met since the beginnings.

If modern purism chose the orderly side - symmetry (nineteenth century), modern architecture has broken with the past, as modernism opted for the chaotic side. An apparent chaos, modernism is however governed by formulas, mathematical equations, even new mathematical theories such as fractal geometry, catastrophe theory, chaos theory or topology.

3. Fractal geometry, a new dimension of human knowledge

Fractal geometry is a new language used to describe, analyze and model the complex shapes in nature. If the traditional elements of the language of Euclidean geometry are forms visible as lines, circles, spheres, the new language elements are algorithms that can be converted into shapes and designs only with the help of computers. The algorithm is a powerful descriptive tool. For example, if such a language should be formalized - say experts - we could describe the formation of a cloud as simple and accurate as an architect who describes a house using traditional geometry elements.

We will further illustrate the generation of natural elements with the help of fractal geometry, as well as the definition of fractals as attractors of systems of iteration functions. We need some theoretical preliminaries

.

Let (X, d) be a complete metric space.

Definition: The set H (X) consists of non-empty compact subsets of X.

Definition: Let $x \in X$ and $B \in H(X)$.

$d(x, B) = \min\{d(x, y)/ y \in B\}$ represents the distance from x to B.

Definition: Let A and B from H(X).

$d(A, B) = \max\{d(x, B)/x \in A\}$ represents the distance from A la B.

$h(A, B) = \max\{d(A, B), d(B, A)\}$

It can be shown that h defines a metric on H(X), called the Hausdorff -Pompeiu metric.

Theorem: (H(X)) is a complete metric space.

The metric space H(X) is the space where the fractals are found.

Definition: Let (X, d) be a metric space. The function f: $X \to X$ is named a *contraction function* if there exists $k \in [0,1)$ so that $d(f(x),f(y)) \le kd(x, y)$, for every $x, y \in X$.

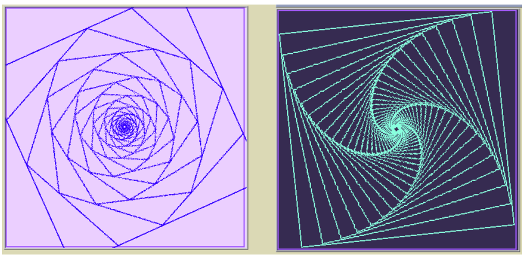


Figure 1. The successive transformations of a square of sides 1 after some contractions

Contraction principle (Banach)

Theorem: Let (X, d) a complete metric space and f: $X \to X$ a *contraction function.* Then:

1) f has a unique fixed point u and
2) for any $x_0 \in X$, the sequence $f^{(n)(}x_0)$ converges to u.

Hutchinson Operator

We consider R^2 (the Euclidean plane) as a complete metric space with the usual distance (Euclidean). Let n be a fixed natural number (not zero) and let for any $j \in \{1, 2, ,..., n\}$, a contraction $W_j : R^2 \to R^2$ having the contraction factor k_j. If A is a subset of R^2, we note with $W_j(A)$ the image o the set A by the function W_j.

Definition: *We define the application (Hutchinson operator):*

$$H : H(R^2) \to H(R^2),\ H(A)=W_1(A) \cup W_2(A) \cup \ldots \cup W_n(A).$$

We will note: $H = (W_1, W_2, \ldots, W_n)$.

Also (R^2 , $W_1, W_2, \ldots, W_n$) *is called iterative function system (IFS).*

Theorem: *Hutchinson's operator is a contraction on the complete metric space of the compact plan parts H(R^2) with the Hausdorff distance. In addition, the contraction factor* ***k*** *is the largest element of the set* $\{k_1, k_2, \ldots, k_n\}$.

Definition: *The fixed point F∈H(R^2) of the Hutchinson operator (it exists and it is a unique according to the contraction mapping principle) is called the attractor of the iterative function system (deterministic fractal) and it is the limit of the string* $H_n(A)$*, for every A∈ H(R^2).*

These notions, which may seem too technical for students in secondary education, can be understood because they are richly illustrated with programs made in the LabVIEW environment, a software package that we have called **Fractall.**

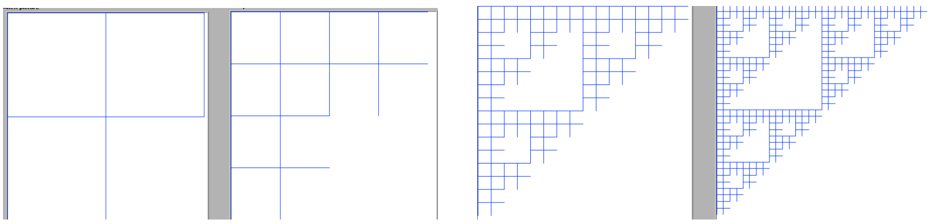
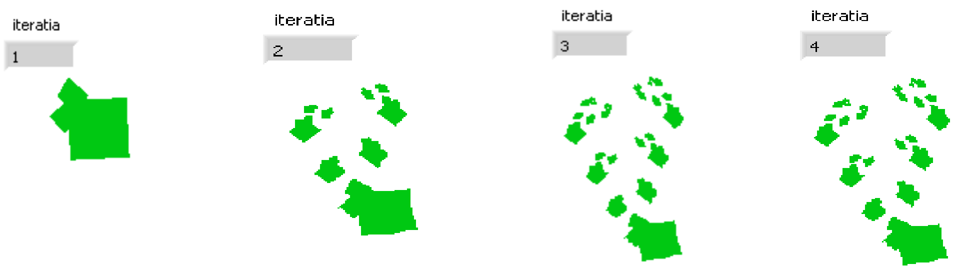


Figure 2. **The Sierpinski triangle** as attractor of an iterative system

The four geometrical transformations which applied successively to a square lead to a fern are:

$$f(x,y)=\begin{bmatrix} 0.00 & 0.00 \\ 0.00 & 0.16 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}; \qquad f(x,y)=\begin{bmatrix} 0.85 & 0.04 \\ -0.04 & 0.85 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}+\begin{bmatrix} 0.00 \\ 1.60 \end{bmatrix};$$

$$f(x,y)=\begin{bmatrix} 0.20 & -0.26 \\ 0.23 & 0.22 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}+\begin{bmatrix} 0.00 \\ 1.60 \end{bmatrix}; \ f(x,y)=\begin{bmatrix} -0.15 & 0.28 \\ 0.26 & 0.24 \end{bmatrix}\begin{bmatrix} x \\ y \end{bmatrix}+\begin{bmatrix} 0.00 \\ 0.44 \end{bmatrix}.$$



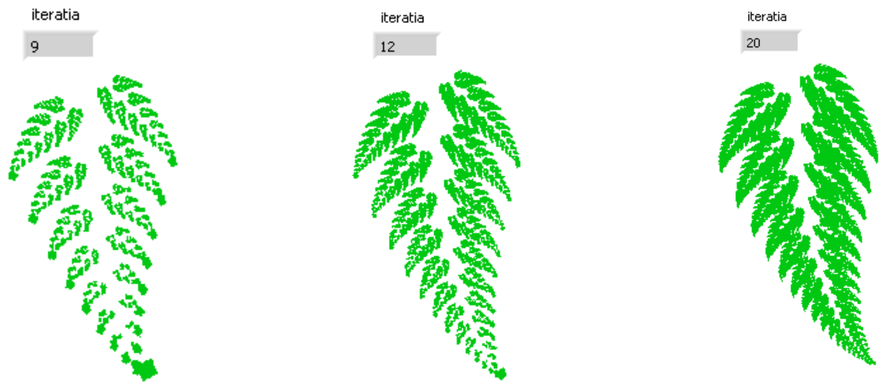


Figure 3. The fern as attractor

Mathematics is the domain of freedom and fantasy for architecture - says Michele Emmer from the University La Sapienza, Rome:

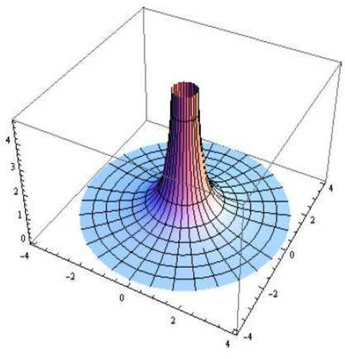
"There are probably two words that express the capacity of contemporary architecture to enrich the capacity of representation and modelling of space: fantasy and freedom, and they are conferred by the new geometries, topology and computer graphics programs."

The best known example of applied fractal geometry is the Guggenheim Museum in Bilbao, Spain, conducted by Frank Gehry (1990), which removes the limits imposed by classicism and brings fractal shapes in the building's design. Here 26 petals are developed and twisted, resulting from the recursive application of an iteration function system.

Figure 4. Guggenheim Museum, Spain

4. Gheorghe Țițeica – a world known Romanian geometrician

At the end of the nineteenth century, the famous Erlangen program of Felix Klein gave the idea of studying geometry by certain groups of transformations. Following Klein's ideas, Gh. Țițeica studied certain curves and surfaces, discovering some affine, centro-affine and projective properties of objects subject to transformations. In 1907 he discovered a class of surfaces in three-dimensional space, today examples of affine fields, thus becoming the first geometrician who studied the affine spheres using Euclidean invariants. A hipersurface Țițeica can be characterized as the locus of points that are at a affine distance fixed from a centre point (considered as the origin). The software can decide whether a surface can be a Țițeica surface and there can also be made graphic representations of the surfaces.



Suprafața $z = \frac{1}{x^2+y^2}$.

Figure 5. Țițeica surface [6]

5. New technologies to support geometry

"The task of education and training based on the new information and communication technologies isn't to demonstrate that it has immediate results in a race with other types of

educational systems, but to replace some of the existing structures with a new, probably superior spectrum of performances, to meet the inherent changes that occur in culture and civilization. "(Istrate, Olimpius. Remote education. Designing materials, Agata Publishing, 2000, p 39.)

Since geometry also involves creating an intuitive support for the mathematical notions, the educational software - very diverse - allows a better understanding of the concepts in the educational process. The software used in teaching has distinctive design features, but what is giving it the quality of an educational software is the teaching strategy underlying its design and use.

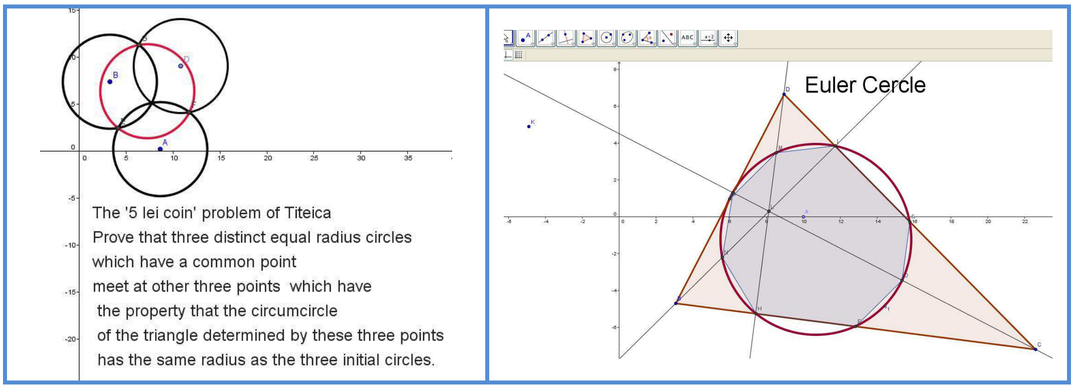


Figure 6. Illustration of two results from classical geometry using the GeoGebra program: The ”5 lei coin” problem of Ţiţeica and Euler Cercle.

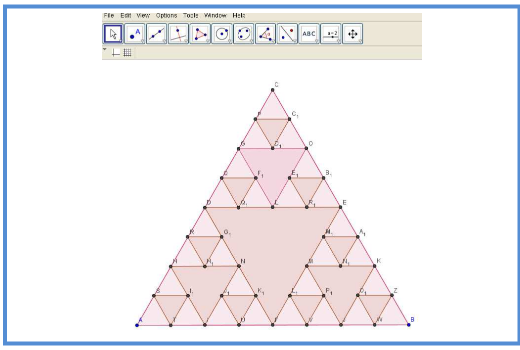


Figure 7. The Sierpinski triangle as a Geometric fractal (GeoGebra)

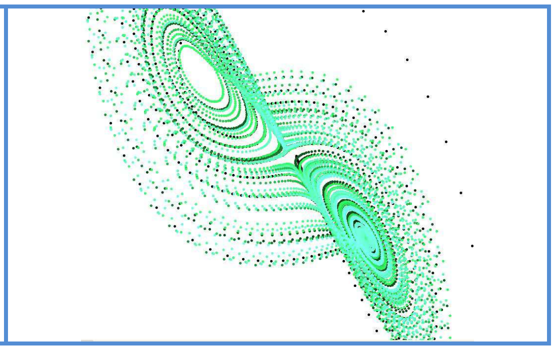


Figure 8. The Lorenz fractal generated with the Fractall program package

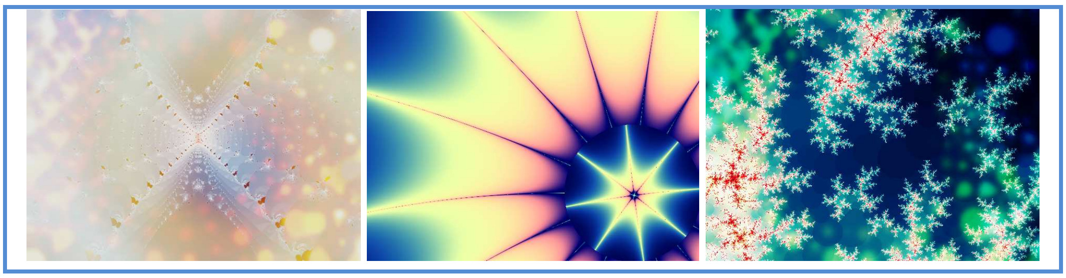


Figure 9. Fractal art realized in school fractal projects

"Mathematics is a way of expressing natural laws, it is the easiest and best way to describe a general law or the flow of a phenomenon, it is the most perfect language in which one can narrate a natural phenomenon." **Gheorghe Țițeica**

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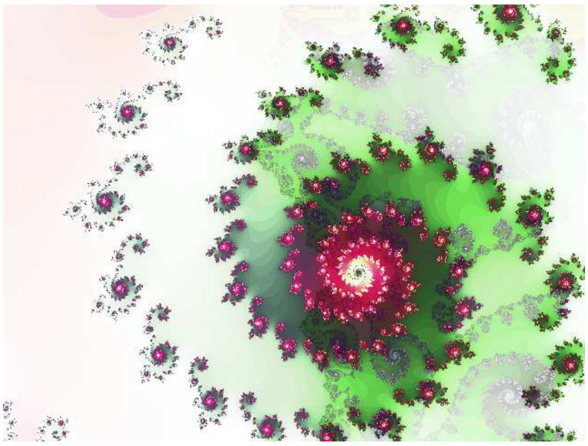
Moise, D. L. and Druță, D. (2012): *Fractall - pachet de programe pentru studiul geometriei fractale.* In *Proceedings of The 10th National Conference of Virtual Learning,* Brasov, 215-222.



Section

TECHNOLOGIES

Technologies (TECH):

- **Innovative Web-based Teaching and Learning Technologies**
- **Advanced Distributed Learning (ADL) technologies**
- **Web, Virtual Reality/AR and mixed technologies**
- **Web-based Education (WBE), Web-based Training (WBT)**
- **New technologies for e-Learning, e-Training and e-Skills**
- **Educational Technology, Web-Lecturing Technology**
- **Mobile E-Learning, Communication Technology Applications**
- **Computer Graphics and Computational Geometry**
- **Intelligent Virtual Environment**

Moses Software

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Abstract

This document presents the MOISE scenario from the project entitled 'Man from earth to sky-flight-aviation-Universe' belonging to the 'Multitouchcnme Team'. It contains an overview of the whole E-learning application. The 'Multitouchcnme Team'from 'Mihai Eminescu'National College Satu Mare won the first prize for the N-V region, a multi-touch laboratory in the "Learning for knowledge society" project implemented by the Project Management Unit with Foreign Finance-Education Ministry in partnership with SIVECO ROMANIA and 'Carol I' National Defence University.

Keywords: Moses, multi-touch, Mihai Eminescu National College, E-learning

1. Introduction

Moses (English for MOISE) is an artificial guide to our E-learning application. The initial idea came to us from the well-known yet very underrated paperclip helper in early office releases. Moses was designed to be an interactive companion throughout the educational journey prepared by the overall project. MOISE is an acronym in Romanian, it translates into "Machine, optimized and integrated in educational systems", a definition which fits its purpose rather like a glove fits a hand. A schema is presented in figure 2. The software as a whole was designed to blend a multitude of different virtual learning tools including websites, blogs, animations, interactive games etc.

Figure 1. One of the people representing Moses

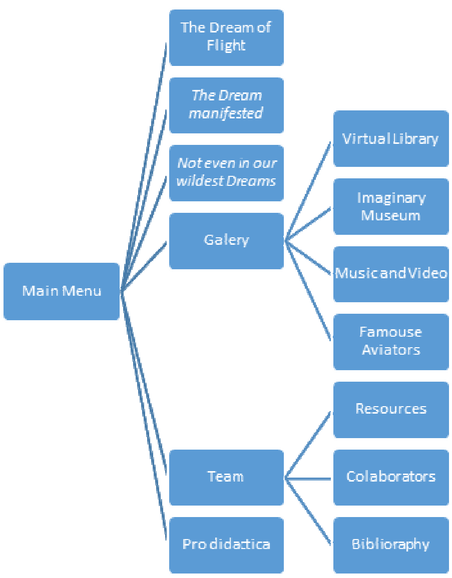

Figure 2. The Main Menu's Structure

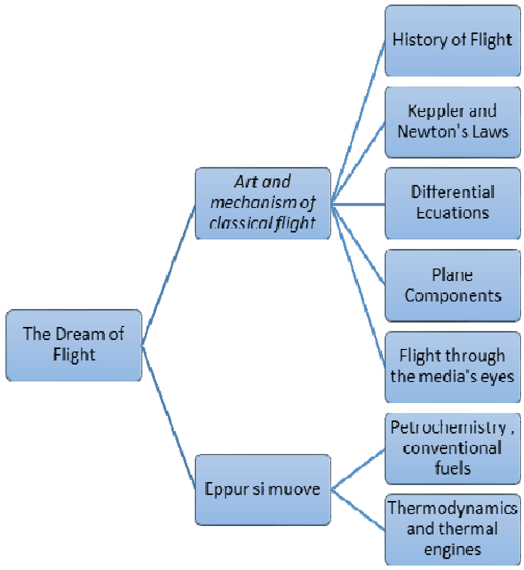

Figure 3. The Dream of Flight

2. Structure

The E-learning application follows a transdisciplinary approach. We opted for a presentation of flight based on a time axis as opposed to breaking it in individual disciplines. Figure 7 presents the contents of the project to some extent. We identified 3 key periods with regard to the aviation industry, namely pre-flight, early flight (before jet engines), and modern flight (after jet engines) each having either 2 or 3 of its own subsection.

The full structure of the 3 periods (in our application they were modelled as chapters) is as follows:

"The dream of flight" (fig 2) representing humanity's pre-flight years, and all the flight-related knowledge related to that era. It has 2 main parts:

The first part studies the close and the material ranging from Archimedes' laws to a study of the flight of birds, and the (previously) crazy ideas of people like Galileo and Leonardo da Vinci.

The second part studies the distant and the sacred with an accent on cosmology, astrology and the solar system

"The dream manifested" (fig 3) representing mankind's first victories over the skies up until the invention of the jet engine revolutionized aviation. It also consist of 2 parts with an addition entitled "Aviation though the media's eyes".

"Art and mechanism of classical flight", consisting of a history of man's first balloon flight and first airplane models(including the non-functional ones), a study of Keller's and Newton's laws, as well as a brief introduction in higher mathematics (differential equations) , also included in this chapter a history lesson in military aviation and the main components of an airplane.

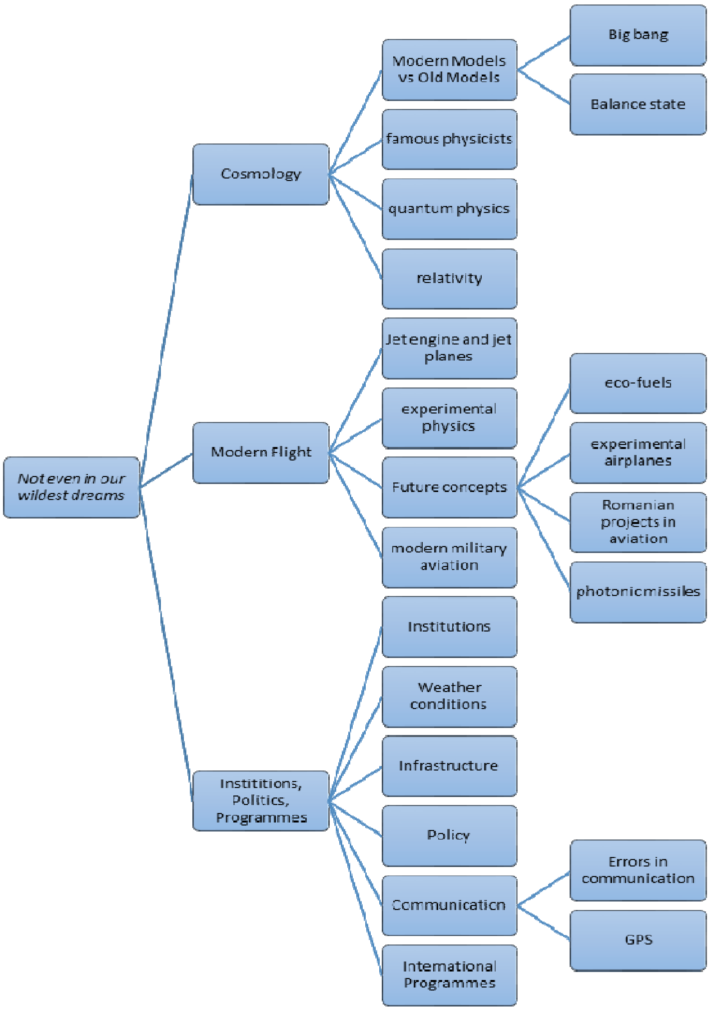

Figure 4. Not even in our whildest dreams

"Eppur si muove" , meaning "and yet it moves" word allegedly said by Galileo when facing the inquisition. It is in fact a study of that which makes planes move, thermodynamics and petro-chemistry.

"Not even in our wildest dreams" (fig 4) representing contemporary aviation. This chapter is formed of 3 parts:

"Cosmogony present and future" realising an in depth study of contemporary cosmologic models and the famous physicist advocating them, as well as an introduction in relativity and quantum physics

"Modern Flight" presenting the jet engine , modern military aviation, aviation and sports, elements from experimental physics. All that and future concepts.

"Institutes, policies and international programmes" including aside from the elements in the title, weather conditions.

The Web platform consists of: web pages for multimedia lessons link to our Wiki page links to our theme related blogs:

- **"New Generation"** http:// proiectnewgeneration.wikispaces.com/
- **"Flight"** http://echipamultitouchcnme.blogspot.ro/

Educational Software Educational Games: The Little Prince, Radu's PlanePro Didactica: teachers' lesson scripts Our document archive.

3. Technical aspects

The application was designed to be user-friendly and with high lesson granularity. It consists of multiple small modules. This is done to allow for easy access to different components. Its granularity allows for the easy removal, addition or modification of any one lesson without affecting the whole. For the software's constructions a number of different tools and skill sets were used.

The graphical part of the application was done primarily with the use of tools like Photoshop (for button and user interface design) and Vegas pro for the video editing and generally for everything Moses-the-guide related (at least as far as graphics is concerned). Also Dreamweaver for some of the supporting websites presented as lessons.

The software was written and built in Adobe Flash. Flash was chosen as the main development platform because of its versatility and the easy integration of different components.

Together with the aviation experts we consulted, we have condensed what we believe to be the most important aspects related to aviation not generally covered in schools throughout Romania.

Following the realisation of the basic schema, the next step in the development process was research. The team was divided into two main groups, one handling research:

One team was responsible for content, their research was centred on aviation, and their main task was extracting and building the actual lessons that were to be included in the software

The second team was the development team, their focus being on flash, audio and video editing. Their main task was to attempt to build whatever was decided by the content team and approved by the coordinators.

During the research phase the development team was responsible for the creation of the UI, the filming and editing of different behaviours for Moses. This included filming and editing "idle" loops to ensure that even more text-filled lessons would not be too static. Some loops included Moses looking at the actual lesson and taking notes, pretending to fall asleep etc. When the content team finished the initial research and started providing lessons the focus was shifted on inserting the lessons into the application. The finalised product was then presented at two conferences in Bucharest (one of which was at the invitation of our aviation experts).

The project's interface represents Moses in the first hypostasis. Also here we have the UI which links to the rest of the project. Every chapter of the research project has a symbolic interface. The Figure 6 below, represents the period before the first lift off, from the Laws of Archimedes up to the study on bird's flight.

Figure 5. The main UI (User Interface)

Figure 6. The "Dream of flight" UI

Figure 7 represents the contemporary aviation being suggested by attractive, dynamic and friendly interface.

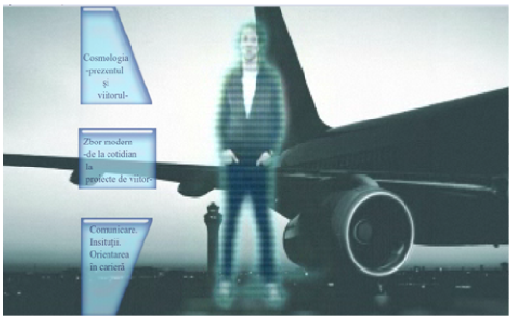

Figure 7. The " Not even in our whildest dreams"UI

	"*Educational process aptimized in view of competence within a knowledge based society*" Project, Siveco Romania and Education Ministry. *Gold Award* at the Project World Championship: IPMA International Project Excellence Award 2013. Ref.: http://ipma.ch/award-news/ipma-announces-winners-of-the-project-excellence-award-2013/

4. Conclusion

The Moses software was a daring E-learning application proposed by a team of high-school students dedicated to learning everything they can about the subject at hand. A very powerful tool in its shaping was the numerous high-school students that took part in its development. Their position and insight allowed for truly fabulous application to be created, and what is most important of all is maybe the fact that together it is an application high school students themselves could see using.

Applied Physics Projects Using the Arduino Platform

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Abstract

The element of novelty and innovation is an extremely important factor for any educational endeavour. In this respect, the Arduino open-source platform could be considered an extremely useful resource for the setup of innovative applications or projects in the physics class. Designed as a small-sized microcontroller, it is capable to collect data from the surrounding environment through a series of sensors, such as distance, pressure, vibration, temperature, humidity, acceleration, force, light, PIR sensors etc. The present article focuses on the creative uses of the Arduino Uno platform in the physics class. This platform is based on the microcontroller ATM328 and has an architecture compatible with a wide range of tasks in automation: from the control of the servomotors inside a robot to the analysis of environmental parameters through a weather station. With a minimal investment and a substantial economy in terms of space, time and materials needed for certain projects, the teacher and the students are able to perform a series of exciting applications in the physics class. Moreover, through the use of this Arduino platform, the students are invited to improve their computing skills, as basic notions of C/C++ programming are needed to operate the platform. The class can thus be engaged in attractive projects of applied physics, because Arduino provides a nearly limitless array of applications which create a fun learning atmosphere.

Keywords: Arduino, microcontroler, sensors, physics projects

1 Introduction

The advancement of the scientifical research in the field of micro and nanotechnologies has led to the worldwide spread of processors and microcontrolers. The microcontroler operated platforms have revolutionized the way we design and construct automatic systems in the industrial and domestic sector. An example of a microcontroler-based platform is Arduino. This platform can receive data from the environment through an extended use of sensors, such as temperature, humidity, atmospheric pressure, distance, acceleration, rotation, light sensors etc. (*see* Figure 1).

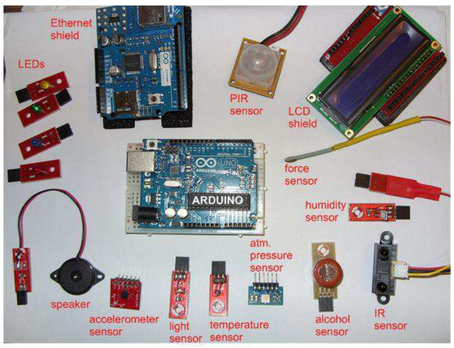

Figure 1. Arduino platform with sensors and other devices

The Arduino board can communicate data through the Internet, using specific devices: Ethernet shields, WiFi shields, GSM devices and can connect to a computer or a mobile phone through a Bluetooth connector. The platform can control with a high degree of accuracy the DC electric motors used in robotics, the servomotors and the stepper motors used in the industrial sector. Some authors have already started reporting about their experience with Arduino-based projects (Margolis, 2013; Ribaric and Younker, 2013), but literature in this field is still in its infancy.

At the same time, Arduino is a powerful didactic instrument that creatively appeals to the student's knowledge in the field of physics, informatics, electronics and technology. Using this platform in the science classes gives the students skills that can become important premises for choosing a profession in the robot design and programming sector.

In this paper we described just a few of the didactically relevant projects that we developed using Arduino: a flower watering alarm system triggered by a soil moisture sensor, a weather station which can send data on GoogleDocs and a robot-car using a motor driver.

2 Flower watering alarm system triggered by a soil moisture sensor

The accomplishment of this project was quite easy. We used an Arduino board, a moisture sensor made of two metallic electrodes introduced into a flower pot and an optical alarm device: a LED which turned on every time the plants needed water (*see* Figure 2).

The metallic electrodes made of copper (or stainless steel, such as the telescopic antenna segments) were placed in the flower pot at a distance of 1cm from each other. With the help of an ohmmeter we measured the electrical resistance between the two ground electrodes. One could notice that the value of the electrical resistance depended on the level of humidity in the soil: the wetter the soil got, the lower the resistance of the electrodes system.

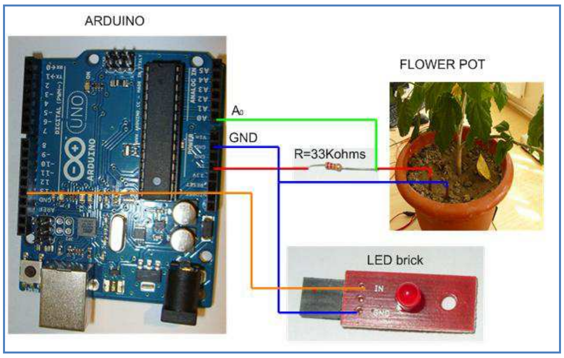

Figure 2. Experimental scheme

We performed resistance measurement tests using different flower pots. For the resistor R connected to the system we selected a medium value R=33kohm, between the value associated with the dry soil and the value measured for the humid soil.

By assembling the system Arduino-resistor-electrodes-flower pot we created a voltage divider. One can notice that the second resistor, other than the one placed in the scheme, is determined by the electrodes grounded in the flower pot. When the soil becomes more dry or more humid, the value of the resistance changes, which leads to a shift in the value read by Arduino.

The experimental measurements performed with the ohmmeter have marked out values of the soil resistance between 10 and 100kohm, depending on its degree of humidity. In such circumstances, we decided to use a resistor with the value of 33kohm for this project. In order to monitor the data in *Serial Monitor*, we used the following source code (see Figure 3).

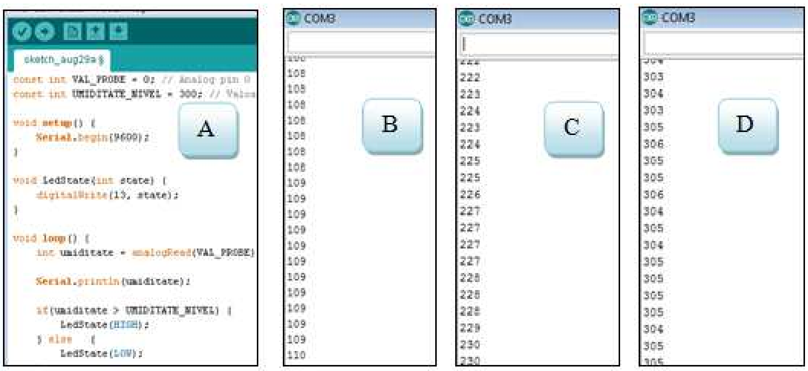

Figure 3. Source code (A) and data in *Serial Monitor* for:
humid soil values (B), threshold humidity values (C), dry soil values (D)

The threshold of humidity was established at the value of 230 units after repeated data monitoring tests from *Serial Monitor* were performed. Above this value the humidity level of the soil is reduced and the LED turns on and under this values the LED stays off.

The project can be perfected by adding an acoustic alarm instead of the optical one or by installing a GSM shield that enables the user to receive an alert either through SMS or through e-mail.

3 Weather station

Using the Arduino board, a BMP085 sensor and an Ethernet shield for Arduino we assembled a weather station for the collection of temperature and atmospheric pressure data which we stored online on a Google server as an Excel document. The BMP085 sensor is a high precision sensor capable of measuring atmospheric pressure and temperature. Given the fact that the atmospheric pressure varies with altitude, based on the measured values, the altitude can be calculated. The Ethernet shield was placed on top of the Arduino board, making sure that the pins would fit correctly into the board (*see* Figure 4).

With the help of the RJ45 cable, the shield was connected to a switch in the local network. After installing the Ethernet library which accepts the DHCP protocol, we stopped and reopened the developement environment in order to update the data. The following program was uploaded on Arduino (*see* Figure 5).

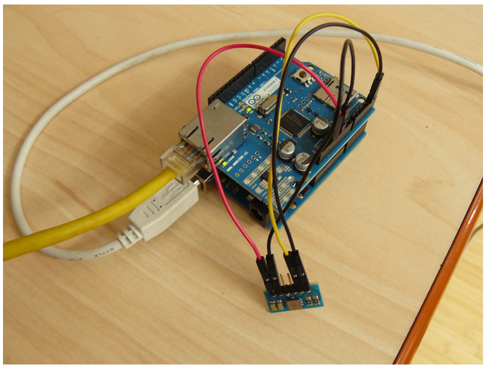

Figure 4. Arduino Shield Ethernet

Figure 5. Arduino code – Weather station

In *Serial Monitor* we received a confirmation message for connecting the Arduino board to the Internet through this shield, which we verified by sending a ping to the google.com server (*see* Figure 6).

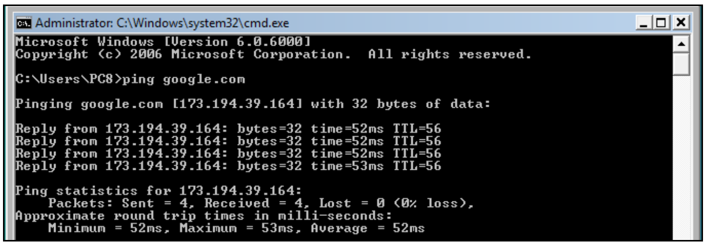

Figure 6. Pinging the Google server

Using the computer on which we installed the Arduino folder we accessed the address: http://www.docs.google.com. It's here that we created a spreadsheet form containing two text fields, one for temperature and one for atmospheric pressure (*see* Figure 7).

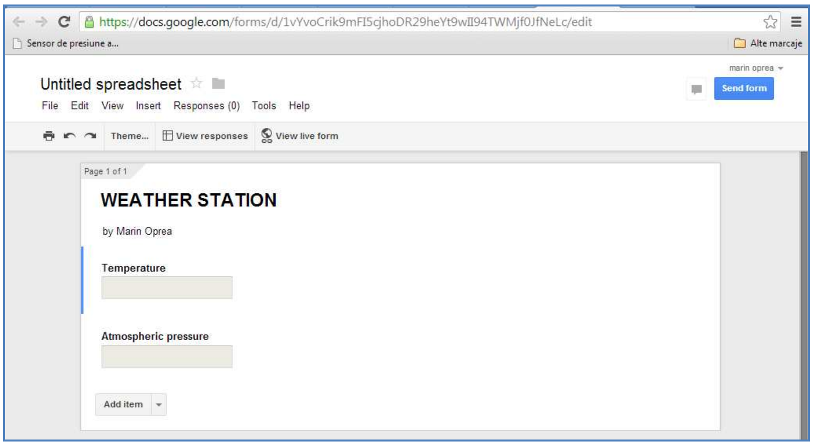

Figure 7. Spreadsheet created on GoogleDocs

From the menu *Form* we selected *Go to Live Form* in order to see the form created by GoogleDocs for the gathering of data. By analysing the source code of the page (View Page Source) we localized the *Form Key*, which is an unique series of characters associated with the form and the codes associated with the text fields which we introduced in the code lines used by Arduino for the Internet connection (*see* Figure 8).

The form can now receive the data offered by the BMP085 sensor, whose activity was monitored at the same time on *Serial Monitor*. Finally, the data, which was updated every 15 seconds, is to be found listed in the GoogleDocs form, where a user can monitor it in real time (*see* Figure 9).

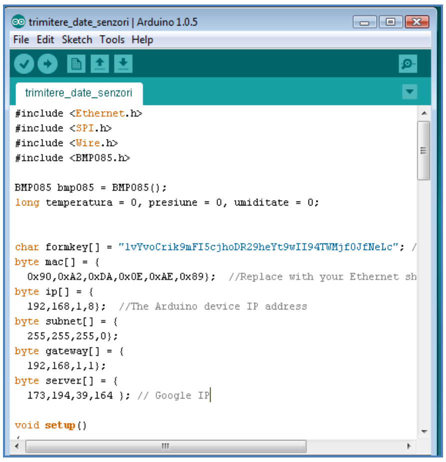

Figure 8. Weather station Arduino code

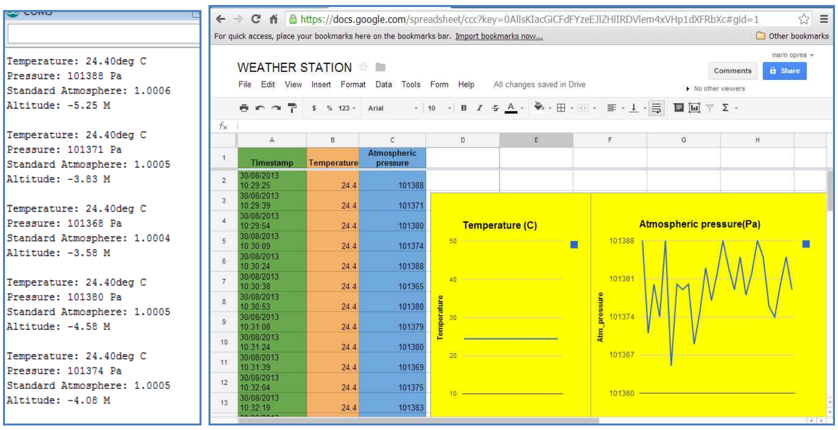

Figure 9. Data transferred on GoogleDocs

4 Robot-platform using Arduino and a motor driver

The assemblying of the robot was performed using a kit which included two DC current motors, two specially designed wheels, a chassis made of plexiglass and a set of connectors – bolts and nut bolts (*see* Figure 10).

Figure 10. Arduino kit for the construction of a robot

For powering up the robot we used a battery container that delivers a tension of 6V required by the motors. The free run speed of the motors is 85 rotations/minute and the values of the free run current amounts to 70mA. The stall current absorbed by the motors is 800mA and the stall torque that they generate is 5,4kgf * cm. The robot assembly procedure began by covering the wheels with the provided rubber bands and continued with the coupling of the wheels and the motors (*see* Figure 11).

Figure 11. Assemblying the wheels

Securing the assembly wheels-motors on the chasis was done with the help of some plexiglass plates (*see* Figure 12).

Figure 12. Securing the assembly wheels-motors on the chassis

After installing the metallic support wheel, we placed the Arduino board on the chassis, on top of which we inserted the driver motor shield L298N. The motors were connected to the pins named Motor1 and Motor2, while the powering of the motors was done through the pins VIN and GND.

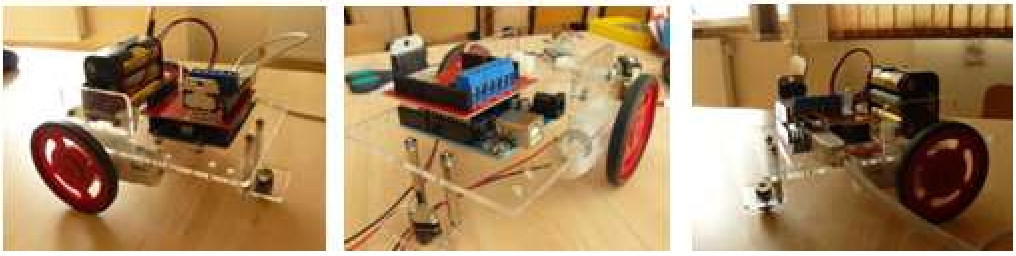

Figure 13. Assembled Arduino robot

We performed several tests for the movement of the assembled robot (*see* Figure 13), modifying in the source code of the motor drivers the values of the rectilinear displacement times between two trajectory changes (*see* Figure 14).

```
go(255,-255);
delay(1000);
go(-255,-255);
 delay(1000);
go(-255,255);
 delay(1000);
go(255,255);
 delay(1000);
```

```
go(255,-255);
delay(1000);
go(-255,-255);
 delay(5000);
go(-255,255);
 delay(1000);
go(255,255);
 delay(5000);
```

Figure 14. Altering the Arduino code

The next step in developing this platform resides in the automatic control of the displacement direction on an obstacle course using proximity sensors, either ultrasonic (Parallax) or infrared (Sharp) (*see* Figure 15).

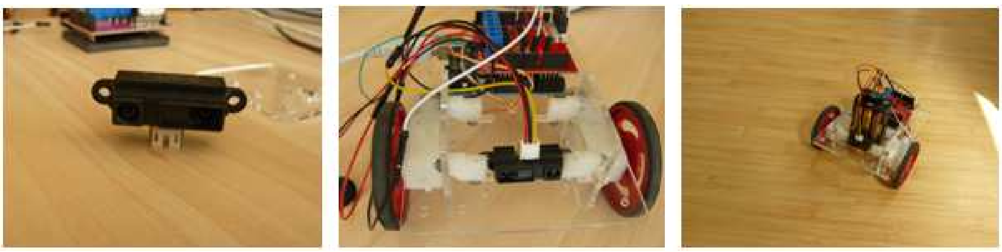

Figure 15. Testing the Sharp sensor

At the same time, the platform can be controlled through Bluetooth with the help of a mobile phone using application Amarino, which can be downloaded for free on an Adroid smartphone.

5 Conclusions

The projects of applied physics using the Arduino platform have boosted the students' motivation for the study of the scientifical and technological subjects. In the field of physics, we noticed an important increase in the understanding of the main physical quantities – distance, force, temperature, pressure, acceleration etc. – through the study of the sensors' functioning manner. In the field of technology, the students have developed working abilities with motors, electric devices and mechanical assemblies. In the field of electronics, they understood the functioning principles of simple electric devices – resistors, capacitors, LEDs, transistors, but also of integrated circuits with specific functions used in the constructed assembly. With respect to informatics, the necessary C/C++ notions required to program the Arduino board were studied, together with terms from the field of information and communication technology, which were understood by studying the Intenet connection protocols of the platform.

During the course of these projects, the students showed an innovative, creative and collaborative spirit, along with an ongoing commitment in the development and accomplishment of the projects. The outcomes were reflected in the improvement of their school performances in all scientific subjects. In conclusion, we are convinced that such projects give physics education a greater quality and efficiency.

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Preliminary Experiences with a Tablet PC Based Learning

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Abstract

As mobile technology develops, it creates new opportunities for enhancing the learning experience of students at all levels of education. Because tablets combine computing power with portability, they already demonstrate a profound effect on education. The aim of this study was to investigate the efficiency of tablet computers usage as a learning tool. An application was designed specifically for practice simple vocabulary learning task on the tablet PC. Participants of the study were 40 students whose task was to match the term in English with the corresponding term in the Serbian language. Measured by the number of correctly matched items, better performances were achieved while using tablet PC. Considering subjects achievement, tablet showed benefits, with greater accuracy in matching images to words. The results show statistically significant gender differences. Besides the fact that students did not require a great deal of instruction in the use of tablet, the study illustrates the ability to blend traditional education with tablet-based education.

Keywords: Tablet PC, Learning tool, Gender differences

1. Introduction

Mobile learning involves the use of mobile technology, either alone or in combination with other information and communication technology (ICT), to facilitate the learning process. Learning can unfold in a variety of ways: people can use mobile devices to access educational resources, connect with others, or create content, both inside and outside classrooms. Mobile technologies, by virtue of being highly portable and relatively inexpensive, have enormously expanded the potential of personalized learning. Although long-term cost–benefit analyses still needs to be conducted to compare the total costs of paper versus digital learning interfaces, it is already clear that mobile devices offer rich feature sets at increasingly low prices (UNESCO, 2013). The continuous development of computer technology and software provides an opportunity for the efficient transfer of data. As a cosequence, people often prefer to access information on computers because of the availability of the information, the possibility to change text to the desired size, ease of archiving and organization, avoidance of paper costs through reduced paper use, and environmental benefits (Dyson, 2004; Garland and Noyes, 2004; Rose, 2011).

The capabilities and skills for safe and effective utilizing a broad range of devices, software and services in a rapidly evolving and highly diverse technological landscape are increasingly important to all who use screen-based ICT (Moore et al., 2008). Computers, the Internet, hand-held devices, and a host of other technological marvels have altered the concept of knowledge transfer. This reality has prompted considerable interest in finding fruitful ways of integrating mobile technologies, such as wireless laptops and tablet computers, into educational settings. In this regard, the variety of mobile devices available nowadays, presenting different characteristics, such as input possibilities and ergonomics (Guerrero, 2006), calls for investigating whether device-specific affordances may positively, or even negatively influence teaching and learning processes.

Although the Tablet PC is a highly commercial product, because of its relatively new introduction, scientific research on the use of Tablet PCs has been lacking (Ozok, et al., 2008). Given that some studies found improvements in memory retention when subjects used tablet PCs (Ando and Ueno, 2010; Gasparini and Culén, 2012) we tried to examine whether tablet would be effective in the vocabulary learning task.

2. Method

The aim of this study was to investigate the efficiency of tablet computers usage as a learning tool, in comparison to the traditional paper-based learning. An application was designed particularly for practice simple vocabulary learning task on the tablet PC.

A total of 20 participants completed the learning task with the stimuli presented on paper sheets. There were ten females and ten males in the sample. The average age of the sample was 21.8. Another group of 20 participants completed the same learning task using tablet PC. There were twelve males and eight females in the sample. The average age of the sample was 22. The participants were each given a Prestigio tablet, featuring a 7-inch touch screen, Wi-Fi connection, a webcam, and basic audio/video functionalities, running Google’s Android OS.

The stimuli material - the new vocabulary items from Transport and Traffic Engineering field that are commonly used, were paper forms adapted to the mobile environment, delivered by power point presentation. The presentation contains 18 slides divided into two sessions. Counterbalancing was designed into the study to control for order effects. The first session comprised of nouns and their representative images. Most of the slides consisted of 3 words and 3 images (Figure 1), while some slides are with 2 words and 3 images. The total item pool, i.e., number of words to be learned was 22. The task was to link a noun in English language with the appropriate picture. The second session consisted of nouns in English (identical items as in the first session) and the corresponding nouns in Serbian. The task was to match the term in English with the corresponding term in the Serbian language. Number of correct answers on each item served as a measure of learning efficiency.

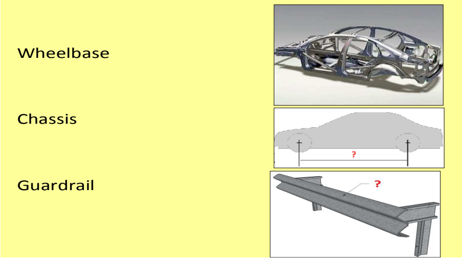

Figure 1. Learning interface

3. Results and discussion

Since the findings indicate that the person and item statistics derived from the two measurement frameworks are quite comparable (Xitao, 1998) the results will be presented in both ways, on the item-level, as well as on the individual level. The descriptive statistics for the two learning conditions using different media, represented by the number of correct responses to each of the items are reported in Table 1.

Table 1. Descriptive statistics for the number of correct responses per items

Per items	Paper, image/word	Paper, word /word	Tablet, image/word	Tablet, word /word
Mean	14.64	15.36	15.64	15.95
SD	1.81	2.08	4.18	4.74
Variance	3.2900	4.3377	17.4805	22.4264
SEM	0.39	0.44	0.89	1.01
N	22	22	22	22
Minimum	12	10	8	4
Median	14	15	18	18.5
Mode	14	15	19	19
Maximum	20	20	20	20
Range	8	10	12	16
Skewness	1.180	-.153	-.673	-1.484
SE of Skewness	.491	.491	.491	.491
Kurtosis	2.472	1.775	-1.204	1.316
Std. Error of Kurtosis	.953	.953	.953	.953
Percentile 20	13.7500	14.0000	11.7500	12.5000
Percentile 50	14.0000	15.0000	18.0000	18.5000
Percentile 75	15.2500	16.2500	19.0000	19.0000

Table 2. Descriptive statistics for the number of correct responses per subjects

Per subjects	Paper, image/word	Paper, word /word	Tablet, image/word	Tablet, word /word
Mean	16.95	16.90	17.70	17.55
SD	2.04	2.00	2.41	2.91
Variance	4.1553	3.9895	5.8000	8.4711
SEM	0.46	0.45	0.54	0.65
N	20	20	20	20
Minimum	13	13	11	7
Median	17	17	18	17.5
Mode	16.00	19.00	16.00	17.00
Maximum	20	20	21	20
Range	7.00	7.00	10.00	13.00
Skewness	-.381	-.244	-1.165	-2.633
SE of Skewness	.512	.512	.512	.512
Kurtosis	-.398	-1.042	1.783	9.180
Std. Error of Kurtosis	.992	.992	.992	.992
Percentile 20	16.0000	15.0000	16.0000	17.0000
Percentile 50	17.0000	17.0000	18.0000	17.5000
Percentile 75	18.7500	19.0000	19.7500	19.7500

Except for the situation were matching images to words on a paper sheet was required, in other three conditions, the distribution was slightly negatively skewed, showing the highest value on the task of matching two pair of words on a tablet screen, when the number of correct answers on each item served as a measure of learning efficiency. When the task was performed using tablet the means were less than the medians. Kurtosis was slightly positive except when matching images to words using tablet, with the highest value in the condition of matching images to words on paper sheet. Comparing the numerical values for skewness with twice the SE of Skewness suggests the relative normality of the data distribution which was also confirmed performing Mann-Whitney's test to evaluate the difference in the responses. Descriptive statistics for the two learning conditions using different media, with learning efficiency represented as the number of correct answers of each participant, are reported in Table 2.

It can be seen that the distribution was very slightly negatively skewed, showing higher values when implementing tablet as a learning medium, with the highest value when the task was to match two pair of words on a tablet screen. Thus, we can consider the distribution to be approximately normal, except for the latest example. Kurtosis show negative values for paper condition and positive for tablet condition. Numerical ways of determining if a distribution is normal indicated approximately normality, except when the task was to match two pairs of words using tablet PC. Measured by the number of correctly matched items, better performances were achieved while using tablet PC, either the learning outcome was represented by the correct responses to each of the items, or as the number of correct answers of each participant. When working with tablet, if the results were interpreted at the item level, more accurate responses were obtained when matching words, which could be interpreted as the learning outcome and vice versa according to subjects' answers. For paper medium, this difference is slightly higher in favor of linking images with words on individual level, while considering the number of correctly answered items, better performance were shown for matching the words. Workings with tablet respondents have fewer errors than when using paper, showing more errors in matching words. The number of errors on item level was generally higher than considering individual results. Again, subjects were more accurate when using tablet, but made fewer mistakes in matching words (Figures 2-5). None of these differences were statistically significant.

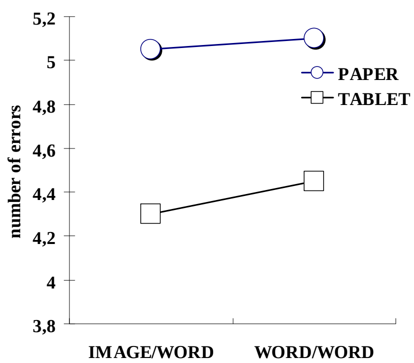

Figure 2. Number of errors per participant as a function of manner of response

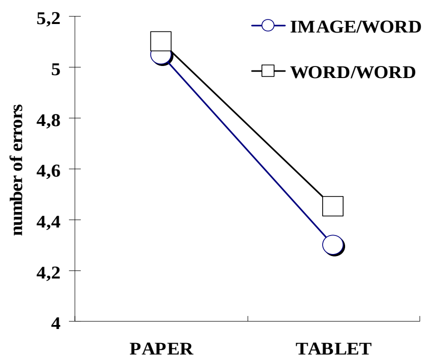

Figure 3. Number of errors per participant as a function of learning media

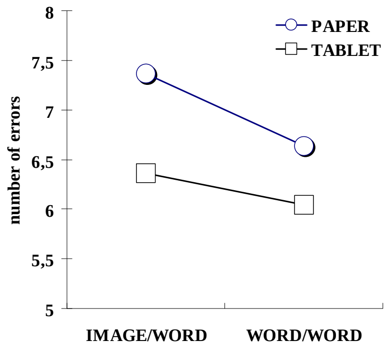

Figure 4. Number of errors per item as a function of manner of response

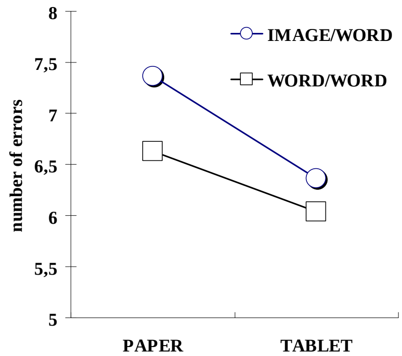

Figure 5. Number of errors per item as a function of learning media

Gender differences did not produce a significant impact, as well as the type of material that has to be recognized and memorized - pictures and words, when learning from paper. To examine how two qualitative categorical variables (male/female) affect the means of two quantitative response variables (image/word vs. word/word matching) when operating tablet two-way analysis of variance was used. The results indicated the significant main effect of gender F (1, 84) = 31.07, p = .0001 on memorizing items presented on tablet screen. Post Hoc comparisons showed that males were superior to females using tablet PC (p = .000).

In the study we were also interested in investigating the hypotheses that dependent variable - responses (calculated as number of correct answers) is affected by (1) medium factor, which has two levels – tablet vs. paper, (2) gender which was also represented with two levels, and (3) the interaction of media type with gender. There was a significant interaction between the effects of gender and learning media on learning outcome, as measured by the number of correct answers on each item F (1, 168) = 24.69, p = .0001. In other words, the effect of learning interface on the number of correct responses depends on gender (p = .002). Simple main effects analysis showed that males were significantly more successful in solving learning tasks presented on tablet PC screen than females F (1, 168) = 26.24, p = .0001.

The results of the experiment demonstrated that the same trends stands for both, paper and tablet PCs. It has to be clarified the nature of their influences on memory and comprehension in the learning process. The answer to the question on how can associations between words and visual representations of objects be memorized and reused later probably could lie in actively involvement in higher-order tasks as analysis, synthesis, and evaluation (Bonwell and Eison, 1991).

Neuroscientists have found that declarative memory system is responsible for learning and remembering words, phrases, and other short fixed “chunks” of language._Imaging research revealed that when asked to remember something, females tend to use the left side of the memory portion of the brain (the hippocampus) with verbal strategies using language as a framework for memory, while males tend to use the right side of that same structure along with visual strategies using pictures and emotions to remember events (Frings et al, 2006; Ionescu, 2008). Adult males have better visual memory than females (Vuontelaetal, 2003). However, women have better verbal memory, particularly when the task is simple memorization or if the task concerns memory for episodes (Halpern, 2000; Lewin et al, 2001; Herlitz and Rehnman, 2008). If visuospatial processing of stimuli such as graphs, charts, formulas, or geometric figures, is required it has been thought that men are better in remembering that information simply through visualization (Lewin et al, 2001). This fact is only to some extent, in contradiction to the findings of our experiment, where has been found that both, females and males showed better performances when the task employed matching images with words, whereas males tend to be superior in tablet usage. In one from the series of previous experiments upon tablet PC usage female tend to show higher mean scores for lerneability dimension, than males (Čicević et al, 2013). Obviously, while it has been commonly held that males show an advantage on spatial tasks, and females on verbal tasks, there is increasing evidence that sex differences are more widespread and complex to interpret than previously supposed (Andreano and Cahill, 2009), and varies depending on the medium used for presenting stimulation.

4. Conclusion

Inclusion of technology in the classroom could help to minimize the individual differences between students, develop their potential, and encourage them to use information technology for learning. However, the use of technology in the classroom does not necessarily equate to increased learning, more effective teaching, or a more engaging learning environment. In education, the merit of technology must be judged on its ability to improve student learning (Beyerbach and Walsh, 2001; Vogel and Klassen, 2001; Batanov, 2002; Stafford, 2005). In other words, technology is only a medium or a tool through which new educational pedagogies may be developed, and the effectiveness of these new pedagogies will depend on how these technologies are deployed.

Some researchers believe that investments in ICT will pay off in the future because the use of technology will lead to educational attainment, which leads to employment, earning power and economic activity (Plowman et al, 2011). As for the learning outcomes, it's important to note that when the conditions at memory encoding match the conditions at memory retrieval, memory retrieval is improved (Goldstein, 2011). Recognizing recurring relationships between a phrase and certain pictures in a mix of images could be an indirect method of acquiring new information across many disciplines.

ACKNOWLEDGMENT

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Optimizing the Test Module in the Easy-Learning Platform

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Abstract

This paper describes on of the recent improvements of The Easy-Learning Platform. The optimization project has the goal of extension and introduction of new standards in the Easy-Learning platform, its development being started in the year 2004 and continued every year. The importance of the eLearning platforms is now greater than ever, the students have access to information no matter where they are in the world, on many types of gadgets. One purpose of this work is to create a user experience identical regardless of the device used. This optimization project supposes knowledge in environments of web programming, data bases, high tech devices and graphical design. The general opinion is that eLearning has changed and will change in the future radically the way that people learn and interact. A variety of technologies have been used in this project, such as HTML5, CSS3, JavaScript, Apache for the servers' part, PHP and MySQL as database. For the testing part a LG Optimus One Smartphone and an ipad Mini tablet have been used.The basic technologies that were used in the platform are Apache web server, PHP dynamic pages and MySQL data bases. The Symfony Framework is the one that stays at the base of the platform with all the facilities that it provides.

1. Introduction

This paper describes on of the recent improvements of The Easy-Learning Platform. The optimization project has the goal of extension and introduction of new standards in the Easy-Learning platform, its development being started in the year 2004 and continued every year.

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The basic technologies that were used in the platform are Apache web server, PHP dynamic pages and MySQL data bases. The Symfony Framework is the one that stays at the base of the platform with all the facilities that it provides.

It happens that by mistake some students close the tests windows and are obligated to start the test over loosing a great deal of time. As a solution we have implemented a pop-up that appears when the user closes the window or refreshes the page, to leave the page a confirmation is need.

2. New features in the Test Module

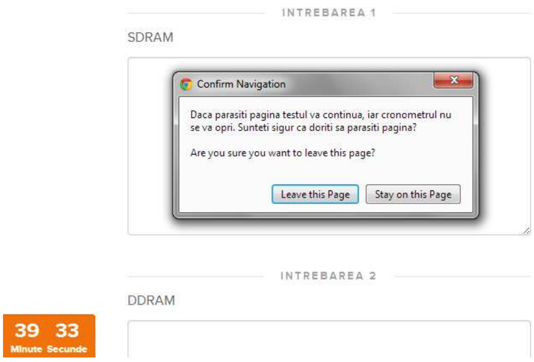

Figure 1. Improved tests

```
$(window).bind('beforeunload', function(){
  return 'Daca parasiti pagina testul va continua, iar cronometrul nu se va opri. Sunteti sigur ca doriti sa parasiti pagina?';
});

$('form#test').submit(function() {
  $(window).unbind('beforeunload');
});
```

If the closing of the application or the pressing of the refresh button is detected with the ‘beforeunload’ event, a dialog box is displayed that has as content the string given by **return**. Then to not display the dialog box when the user presses Save, the ‘beforeunload’ event is deleted when the form is sent.

3. Optimization of Apache using compression schemes

The Apache server has been configured better by applying new practices for improving speed and security.

Firstly the following modules are activated:

- mod_autoindex.c
- mod_deflate.c (helps to compress data before sending them)
- mod_expires.c (helps to control the cache being able to set a life period for a resource)
- mod_headers.c (offers control over the request or answer of the HTTP)
- mod_include.c (offers a filter that processes all the files before sending them to a client)
- mod_rewrite.c (offers the possibility of rewriting the URL)

After that we edit the .htaccess file by adding the following:

3.1. Compression

Compression reduces the response periods by reducing the size of the HTTP response. Starting with HTTP/1.1, the web clients indicate a support for compression with the header Accept-Encoding in the HTTP request. The compression is made with gzip, it being the most popular an efficient method.

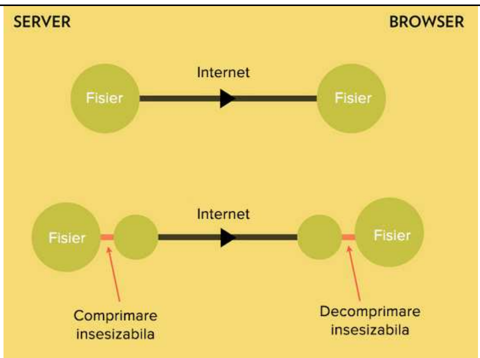

Figure 2: GZIP Compression

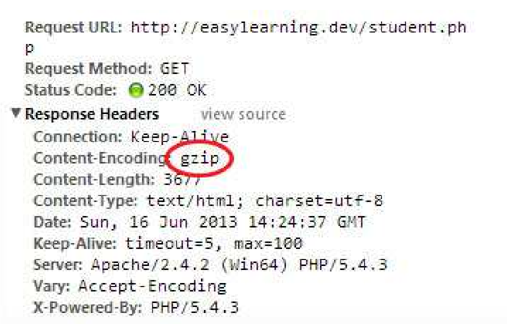

Figure 3: Optimization of Apache with gzip

The code for optimization with gzip is:

```
<IfModule mod_deflate.c>

   <IfModule mod_setenvif.c>
       <IfModule mod_headers.c>
           SetEnvIfNoCase ^(Accept-EncodXng|X-cept-Encoding|X{15}|~{15}|-{15})$
^((gzip|deflate)\s*,?\s*)+|[X~-]{4,13}$ HAVE_Accept-Encoding
           RequestHeader append Accept-Encoding "gzip,deflate" env=HAVE_Accept-Encoding
       </IfModule>
    </IfModule>

    <IfModule mod_filter.c>
       AddOutputFilterByType DEFLATE application/atom+xml \
                                      application/javascript \
                                      application/json \
                                      application/rss+xml \
                                      application/vnd.ms-fontobject
                                      application/x-font-ttf
                                      application/xhtml+xml \
                                      application/xml \
                                      font/opentype \
                                      image/svg+xml \
                                      image/x-icon \
                                      text/css \
                                      text/html \
                                      text/plain \
                                      text/x-component \
                                      text/xml
    </IfModule>

</IfModule>
```

When accessing the announcements page from the student interface we have tested the size of the page and the loading time without the gzip compression and with the gzip compression activated. The results are below:

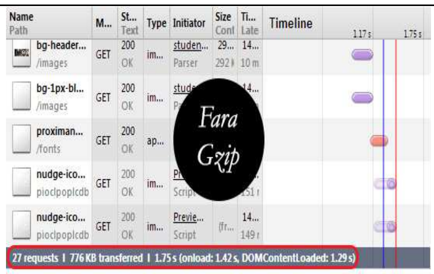

Figure 4: Without Gzip Compression

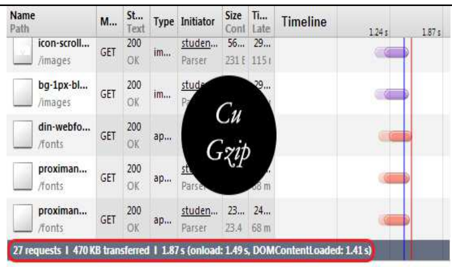

Figure 5: With Gzip Compression

It is observed that when the compression is activated the time of loading is a little bit better because there is no lost time for compressing and decompressing, but there is a significant difference in the size of the page.

3.2. Cache

If the user visits the page for the first time, he must make some HTTP requests, but by using expiration headers we make those components available in cache. The expiration headers are most often used with scripts, style sheets and images. At the next visit the user will not have to make the same requests because he already has the necessary resources for the page. In Figure 6 it is seen that the time in which a CSS files expires is a week.

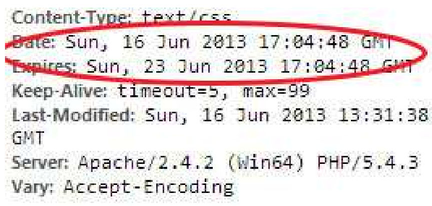

Figure 6: Optimizing Apache with cache

4. Optimization of CSS and Javascript

A pretty recent technique for optimizing CSS and JavaScript is concatenating and minimization of all the CSS files, respectively JavaScript in one or maximum two, to reduce the HTTP requests. Although it may seem as a thing that does not affect very much the performance of the application, it has significant effects on loading the page speed, because the browser can not display the content only after it has access to all the CSS files.

4.1. Javascript

```
//@prepros-append new.min.js
//@prepros-append jquery.jpanelmenu.min.js
//@prepros-append nav.js
//@prepros-append responsive-tables.js
//@prepros-append jquery.countdown.js
```

The above code together with a program called Prepos generates automatically a single javascript file that contains all the files.

Related to the javascript script, it is not necessary that the browser has access to them immediately, being able to load them later. This is why a less used technique, but extremely efficient is the movement of the scripts from the <header> part to the end of the page, just before the closing tags <body>.

Figure 7: Optimizing Javascript

By doing this change a major problem come through: there are pages where JavaScript codes are run only for the respective page and that code being in a view is executed before including the javscript files. For example, in the test page we need JavaScript for the timer. The found solution is using Symfony Slots.

The partials and the components are very good to reuse. But in many cases fragments of code are necessary to create a dynamic zone. For these situations the solution is a slot. Practically a slot is a replacement in which you can put any element from view. Using this replacement is the same as using a variable.

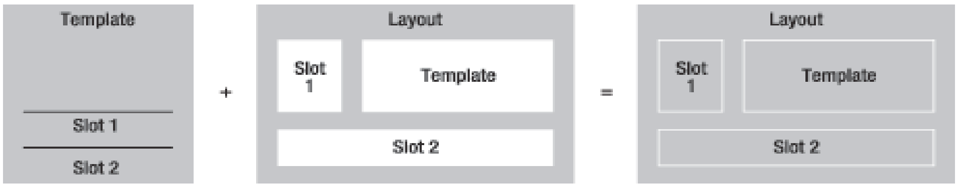

Figure 8 : Example of organization of slots [16]

```
    <?php include_javascripts() ?>

    <?php if (has_slot('scripts_la_sfarsit')): ?>
      <?php include_slot('scripts_la_sfarsit') ?>
    <?php endif; ?>

  </body>
```

After including the JavaScript files, the view is checked if it has a certain slot defined, it is called “scripts_la_sfarsit” and if it is that slot is included in the layout. Below you can see the code for the definition of a slot.

```
<?php slot('scripts_la_sfarsit') ?>

  <script type="text/javascript">
            . . .
  </script>
<?php end_slot(); ?>
```

4.2. CSS

In order to improve the CSS code, a SASS preprocessor has been used, that gives access to variables, a very important thing because it is not needed to remember a color or the spacing of texts, only the variable. SASS also offers Mixins that are a kind of function that helps to repeat the same part of code over and over again. With CSS3 a major problem appeared, every major browser for a relatively new property adds a prefix before it, like it is for gradient:

But using SASS together with the Compass library that contains helping Mixins, al the above code resumes to:

```
.module {
  background: -webkit-gradient(linear, 50% 0%, 50% 100%,
color-stop(0%, #ffffff), color-stop(100%, #cccccc));
  background: -webkit-linear-gradient(#ffffff, #cccccc);
  background: -moz-linear-gradient(#ffffff, #cccccc);
  background: -o-linear-gradient(#ffffff, #cccccc);
  background: linear-gradient(#ffffff, #cccccc);
}
```

```
@import "compass/css3";

.module {
  @include background(
    linear-gradient(white, #ccc)
  );
}
```

Also a useful thing is the utilization of selector inside other CSS selectors, it does not have direct benefits, but code can be written in a much more efficient manner.

```
#add_newGrupa {
  td, th { padding:10px 0; }
  label {margin-right: 10px;}
}
```

5. Conclusions

The Easy Learning platform has suffered many changes across time starting from a simple project it became complex and useful, satisfying most of the needs of the students.

Most of the changes were made to the back-end part, new modules, but the front-end part was not optimized , the old modules had not been revised since their creation. This is the reason why I chose to optimize this part of the platform by rewriting most of the HTML codes from the Views of each module, of some of the files from the Symfony core, also CSS and Java Scripts. Also there was need of a reconfiguration of the Apache server in order to serve faster the pages.

Easy-Learning is a tool that can help not only student but also teachers. It can help with the consolidation of the student's information, avoiding queues at the secretary office.

At this moment the platform has reached a high maturity level with the help of the Symfony framework that simplifies a lot of repetitive tasks, offers the possibility of automatic entity generation, and with the help of the rest of the actual used technologies.

The goal of this project was the making of the platform easier and more pleasant for the user and administrator, to ensure data security and to extend it by adding a new module.

In the future the platform can be extended relatively easy, the HTML code is standardized, at the writing of the CSS a modular approach was taken and the Symfony foundation allows an easy development, the documentation being very well put together. A future direction of development might be the one of updating the Symfony code to version 2, the use of a new data base like MariaDB instead of MySQL or even the implementation of a new module through which the students can be compensated depending on their activity.

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Reconfiguring the Chat Module in the Easy-Learning Platform Using New Technologies

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Abstract

This project of optimizing the Easy-Learning platform supposes knowledge in environments of web programming, data bases, high tech devices and graphical design. The general opinion is that eLearning has changed and will change in the future radically the way that people learn and interact. A variety of technologies have been used in this project, such as HTML5, CSS3, JavaScript, Apache for the servers' part, PHP and MySQL as database. For the testing part a LG Optimus One Smartphone and an ipad Mini tablet have been used. The basic technologies that were used in the platform are Apache web server, PHP dynamic pages and MySQL data bases. The Symfony Framework is the one that stays at the base of the platform with all the facilities that it provides. The Node.js technology is the fundament of the newly added module, the chat. The new and latest contribution to the development of the Easy-Learning platform consists in the diverse optimization techniques used, in the results and code optimization.

1. Introduction

This project of optimizing the Easy-Learning platform supposes knowledge in environments of web programming, data bases, high tech devices and graphical design. The general opinion is that eLearning has changed and will change in the future radically the way that people learn and interact.

A variety of technologies have been used in this project, such as HTML5, CSS3, JavaScript, Apache for the servers' part, PHP and MySQL as database. For the testing part a LG Optimus One Smartphone and an ipad Mini tablet have been used.

The basic technologies that were used in the platform are Apache web server, PHP dynamic pages and MySQL data bases. The Symfony Framework is the one that stays at the base of the platform with all the facilities that it provides.

The Node.js technology is the fundament of the newly added module, the chat. The new and latest contribution to the development of the Easy-Learning platform consists in the diverse optimization techniques used, in the results and code optimization.

2. The new technologies used for the development of the Easy-Learning modules

2.1 HTML5

HTML5 is not a new programming language but is just an improvement in the 4.1 version of HTML. In HTML 5 there were added 5 new tags to ease the upload of multimedia files on pages. We mention: audio files, video, graphical, interactive documents etc.

Other new elements in HTML5 are the tags <header>, <nav> <figure> and <footer> that help the structure of the document. <article>, per example is more generic that "article in a magazine", representing any content that forms an independent part of the document. [7]

HTML5, also, defines in a few details the necessary processing for invalid documents, so that the syntax of errors will be treated uniformly by all the known browsers. [8]

2.2 CSS3

CSS is short for Cascading Style Sheets and is used for the control of style and look of a web page. CSS3 bring a multitude of new things that help a faster and more efficient development of web applications. CSS3 has been split into "modules". The old specifications were divided into smaller parts. The most important modules of the CSS3 are:

- Selectors
- Box Model
- Backgrounds and Borders
- Text Effects
- 2D/3D Transformations
- Animations
- Media Queries

2.3 JavaScript

JavaScript is a programming language that makes it possible for the web pages to be more interactive. It is known as part of the "Scripting Languages". It was launched under the name of "Live Script", the change in Java Script being a matter of marketing strategy.

Java Scripts are introduced in the HTML page and are interpreted and executed by the browser. JavaScript can be considered a very good tool if you wish to control the content of the pages depending on hour, date, operating system or browser, interactive sites that communicate with the user, dynamic sites, data validation forms and not only, these being just a few of the possibilities that the language offers. [9]

Certainly, JavaScript is not perfect. Although it is powerful, it is limited by the severe restrictions imposed by the Web navigators as follows. From security reasons:

- JavaScript cannot read, write, create and delete files on hard disks;
- JavaScript cannot execute operations on the network;
- JavaScript cannot create autonomous applications. In order to write such applications you will need one of the classic languages: Java, C or C++.

2.4. Node.js

Node.js is system software of the server-side type developed to write scalable web applications, especially web servers. Programs are written for the server part in JavaScript, being based on events and asynchronous I/O operations to reduce the necessary resources and to maximize scalability. Node.js was created by Ryan Dahl in 2009 and its development and maintenance is sponsored by the Joyent company.

Node.js contains a HTTP server that makes possible the running of a web server without the use of external software like Apache or LightTpd and that allows better control over the web server. Node.js allows the web developers to create a whole web based application in JavaScript, the part of the Server as well as the part of the Client. [18]

It is based on the virtual machine of JavaScript Google V8 (that is used also in Google Chrome), on the platform abstraction layer libuv and a base library, but it is not written in JavaScript, but in C. That is why Node.js is capable to interact with the sockets of the operating systems and network levels. [18]

At its base Node.js has a loop of events that always check is a new event has appeared, the events being processed one by one.

With Node.js one can create: Websocket Server (as chat), a fast file upload Client, an ads server, and any application of data that runs in real time. Node.js is not: a web framework and Multi-thread (we can think of Node.js as a single thread server). An example of a server created with h node.js on localhost, on port 1337 that respond with "Hello World" on any request follows. [19]

```
var http = require('http');
http.createServer(function (req, res) {
  res.writeHead(200, {'Content-Type': 'text/plain'});
  res.end('Hello World\n');
}).listen(1337, '127.0.0.1');
console.log('Server running at http://127.0.0.1:1337/');
```

3. The Chat Module

Not a long time ago , if we would have wanted to build a chat in JavaScript it would have been necessary to work also with Ajax or Flash. Ajax has week performance, especially in the case of the chat because it is based on requests and answer. Also , the client must ask the server periodically if there are any new messages, consuming resources for nothing. In the case of Flash, a special component must be put in the page to exchange messages with the JavaScript client, then Flash could open a socket to the server. Flash was a better option a few years ago, but now any browser has Flash capabilities.

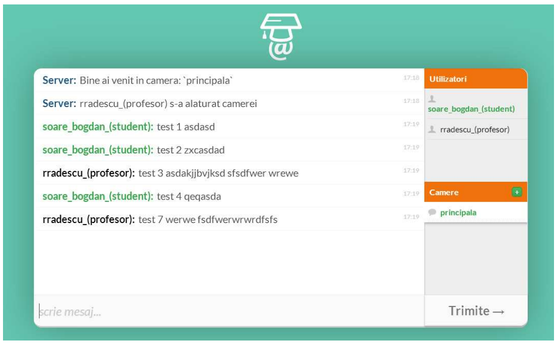

Figure 1: The main Chat window

With node.js and socket.io we can enjoy a better performance, a bidirectional communication between the server and a JavaScript client and even support for every browser.

Socket.IO has the goal of making the applications in real time possible in any browser and mobile device, minimizing the differences between the different transport mechanisms. [25]

Socket.io is able to work with many transports, in the scope of sustaining even the old browsers like IE6. Socket.io selects the most capable transport in the current browser by starting from Websocket as shown below. [26]

Figure 2: Socket.io transports [26]

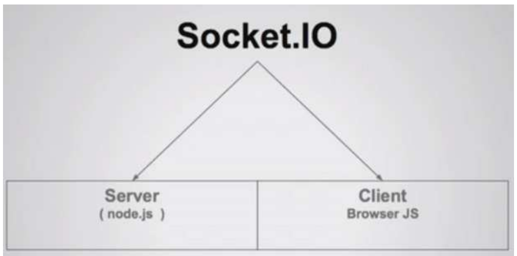

Figure 3: Socket.io Components [26]

Socket.io has two components, one on the server part (node.js) and one on the client part (browser.js). Express is also used, it is a minimalistic and flexible framework for noe.js, offering a robust set of characteristics for building simple and complex web applications.

The Express framework is built on the base of the Connect module from node, giving instruments and a structure that make writing web applications easier, faster and more fun. This includes characteristics like a joined views system that allows the use of almost any template motors, it allows simple utilities to answer to different forms of data, file transfer, routing.

Compared to other frameworks, like Django or Ruby on Rails, Express is extremely small as size. The philosophy behind Express is that the applications vary very much in requests and implementations, so with an easy to use framework we are able to create exactly what we need and nothing more. This philosophy is true for Express as it is for the whole Node community. [25]

The Chat module completes the actual modules from Easy-Learning like the Messenger and Newsletter ones, with its help the students can communicate easier with other colleagues and teachers. [27]

The Chat is organized in rooms, each user has the possibility to add a new room or to adhere to an already existent one.

Figure 4: A window of adding a new room

4. The server & client implementation

In order to transmit a message from the server to the client with Socket.io there are a few options:

- **socket.emit** – triggers an event on the client associated with the socket socket.emit('name event', { data: 'info to send' });
- **socket.broadcast.emit** – the same as socket.emit, it triggers an event on the client, but instead of the client associated to the socket the event is triggered by all the other connected sockets, but for the one that releases
  socket.broadcast.emit('name event', { data: 'info to send' });
- **socket.broadcast.to('room name).emit** – sometimes we want to send an event from a socket to all the other sockets from a certain room
  socket.broadcast.to('room name').emit('event name', {data: info to send' });
- **io.sockets.emit** – sending an event to all the other clients that are connected to the server
  io.sockets.emit('event name', { data: 'info to send'});

5. Comparison between the eLearning platforms

Table 1 : Comparison between eLearning platforms

Platform		Moodle	Fedena	Dokeos	Atutor	Easy-Learning
Cost		Free	Free	Free / Version Pro 100 €	Free	Free
Module	**Multimedia**	Yes	Yes	Yes	Yes	Yes
	Messages	Yes	Yes	Yes	No	Yes
	Messages	Yes	Yes	Yes	No	Yes
	Newsletter	Yes	No	No	Yes	Yes
	Chat	Yes	No	No	No	Yes
	Tests	Yes	Yes	Yes	Yes	Yes
	Questionnaires	Yes	No	No	No	Yes

	Compensate students	Yes	No	No	No	No
	Student Presence	Yes	Yes	Yes	Yes	Yes
	Catalog virtual	Yes	Yes	Yes	No	Yes
Technical info	**Ruby on Rails**	No	Yes	No	No	No
	Apache	Yes	No	Yes	Yes	Yes
	PHP	Yes	No	Yes	Yes	Yes
	MySQL	Yes	Yes	Yes	Yes	Yes
	Windows	Yes	Yes	Yes	Yes	Yes
	Unix	Yes	No	Yes	No	Yes
	HTML5	Yes	No	No	No	Yes
	CSS3	Yes	No	No	No	Yes
	Security	Yes	Yes	Yes	Yes	Yes
	Optimized for mobile devices	No	No	No	No	Yes
	Recuperate data	Yes	No	Yes	No	Yes

From Table 1 it is observed that the Easy-Learning offers most of the facilities and tools that other platforms offer. It is the only platform that is optimized for mobile devices. Also not many platforms offer support for recovering data and back-up, Easy-Learning does this by replicating the data base. One can observe that besides Moodle, Easy-Learning is the only evaluated platform that offers free chat.

5. Conclusions

Most of the changes to the Easy-Learning platform were made to the back-end part, new modules, but the front-end part was not optimized , the old modules had not been revised since their creation. This is the reason why I chose to optimize this part of the platform by rewriting most of the HTML codes from the Views of each module, of some of the files from the Symfony core, also CSS and Java Scripts. Also there was need of a reconfiguration of the Apache server in order to serve faster the pages.

To complete the Messages module, a Chat module has been added. It has at its base the newest web technologies, Node.js, that on short is javascript for servers. This technology assures a dynamic environment, ideal for communicating in real time.

At this moment the platform has reached a high maturity level with the help of the Symfony framework that simplifies a lot of repetitive tasks, offers the possibility of automatic entity generation, and with the help of the rest of the actual used technologies.

The goal of this project was the making of the platform easier and more pleasant for the user and administrator, to ensure data security and to extend it by adding a new module.

In the future the platform can be extended relatively easy, the HTML code is standardized, at the writing of the CSS a modular approach was taken and the Symfony foundation allows an easy development, the documentation being very well put together. A future direction of development might be the one of updating the Symfony code to version 2, the use of a new data base like MariaDB instead of MySQL or even the implementation of a new module through which the students can be compensated depending on their activity.

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DECIDE-IT[1]

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Abstract

DECIDE-IT is a Leonardo da Vinci Transfer of Innovation project which belongs to the Lifelong Learning Programme. DECIDE-IT's main aim is to create an innovative learning method, easily used, which improves learners' abilities when they are forced to take decisions in stressful situations.

Keywords decision-making, eLearning, learning by doing, stressful situations, lifelong training

1. Introduction

The DECIDE-IT project was funded with support from the European Commission - the Leonardo da Vinci Programme.

The Leonardo da Vinci Programme funds practical projects in the field of vocational education and training. Initiatives range from those giving individuals work-related training abroad to large-scale co-operation efforts.

The DECIDE-IT project was an initiative of four partners from three countries:

1. Istituto di Scienze e Tecnologie della Cognizione – Consiglio Nazionale delle Ricerche (ISTC-CNR, Italy)
2. SIVECO Romania SA
3. Engineering Ingegneria Informatica S.p.A. (ENG, Italy)
4. EVERIS Spain S.L.U. (EVR, Spain)

DECIDE-IT considered methods initially used for training personnel managing natural and industrial disasters, methods which will be adapted in order to be used in training management.

DECIDE-IT educational strategy was based on experience which simulated stressful situations without exposing learners to the risks which might be implied.

To this extent, the project adopted a combined approach, mixing classical teaching with playing a role in a 2D environment, monitored by a virtual teacher.

The project targeted 2 strategic objectives. On one hand DECIDE-IT wanted to introduce a formative methodology to create and improve abilities related to taking decisions in stressful conditions. On the other hand, the project targeted an articulated strategy for promoting the suggested solution to the companies, which are the final target of the project and to the scientific community.

[1] This project has been funded with support from the European Commission. This paper reflects the views only of the author and the Commission cannot be held responsible for any use which may be made of the information contained therein.

2. Objectives

The specific objectives may be synthesized as follows:

- testing the already developed system in the former project, DREAD-ED, with small groups of managers (4-5/country) from the Romanian, Italian and Spanish companies which participate to the final test of the product;
- identifying and implementing the necessary technological and methodological adjustments in order to make the product more attractive and efficient for being used inside the companies;
- checking the utility, attractiveness and efficiency of the product by the help of 60 users coming from 3 big private companies from Romania, Italy and Spain;
- marketing to identify the initial clients among the business partners of the 3 companies participating in the project;
- creating partnerships with management schools, institutions for professional training, training units inside companies and other organizations interested in using DECIDE-IT with their own trainees or clients or even for trading the product;
- exploring the economic and technical feasibility of a new organization, legally independent (e.g. a spin-off, an NGO) with the mission of moving forward the development of methods and technologies developed in DECIDE-IT, offering as a guarantee, technical support to new business partners;
- using the website for dissemination actions in the scientific community, by organizing events, participating in conferences, publishing articles in scientific magazines, producing dissemination materials (brochures, posters, etc.)

The project transferred in a new working environment (the society) and a new objective (manager), a practice and an instrument for training communication abilities and decision making, initially made for personnel involved in managing emergency situations.

The product was developed within DREAD-ED project, a LLP-Trasv07 project. The analysis of DREAD-ED results conducted to the idea of a great potential for training the instrument, which turned to be efficient even for training needs different to the original ones.

Consequently, the partnership objective was to extend the instrument application and:

- to adapt it to the managers training needs, which is characterized by a training demand more economic, more flexible and more efficient;
- to introduce it in the companies' training programs, one of the most interested sectors in the field;
- to check its functioning on other targets.

The transfer was not only instrumental but also methodological.

For the instrumental point of view, the transfer consisted in using the game on-line, in 3 European countries different from those involved in the original project and with different goals as compared to the ones for which it was designed and tested.

Using this instrument in new countries and for new goals, will overpass the limits and in the meantime, will develop the potential, which will lead to reaching a different target from the original one.

From the methodological point of view, the project allowed testing in Romania, Italy and Spain the training program in decision making process.

It is worth mentioning that the instrument can be used as a basis for the strategy as "learning by doing" which overpasses the simple transfer of knowledge.

A common methodological approach in 3 big companies from 3 different European countries will allow a coherent language which will be the basis of an innovation transfer in professional training at European level.

DECIDE-IT will also test the possibility of developing an eLearning instrument, attractive for companies and capable of imposing on professional training market.

The trail targeted 60 managers coming from 3 big companies from Romania, Spain and Italy which belonged to DECIDE-IT consortium.

Regarding individuals, there were some benefits easily measured in an assessment meeting:

- acquiring new theoretical knowledge regarding decision making in normal and stressful conditions;
- a better understanding of factors which may affect the efficiency in decision making in normal and stressful conditions;
- trainee's admitting the role of such factors in making his own decisions;
- trainee's admitting the aspects which ask an improvement of his own behaviour;
- improving professional perspectives;
- reducing stress and increasing his personal wellness.

Talking about the benefits for organizations, even if the are more difficult to be measured, they are important to be underlined:

- increasing the efficiency in decision making processes;
- reducing the loss due to delays and mistakes in decision making processes;
- improving relations between decision making factors and other employees,
- decision making factors and clients, decision making factors and suppliers;
- diminishing stress within the organization and improving the indicators of The Quality of Professional Life.

3. Implementation

The proposal for DECIDE-IT professional training was based on a combined strategy, which integrated training in class with an on-line professional training, based on an interpretation of a role in a virtual environment (an efficient method from the pedagogical point of view which stimulates trainees' motivation and reduces in the meantime costs and duration of training).

The experiment developed in 2 phases. In the first phase, the formative assessment, using the system generated by DREAD-ED was tested (originally designed for emergency situations operators) with a small group of managers. The results were used to identify the necessary changes for satisfying the specific needs of the target group.

In the second phase, the cumulative assessment, the efficiency of the adapted product was evaluated with a group of around 60 managers, belonging to the 3 software producing companies, participating in the project. The experiment consisted in forming 4-5 trainees groups. Each group participated in 3 formative meetings, which lasted half a day, a month distance one another. Such a methodological approach was based on a preliminary analysis of the characteristics of the target group.

In each meeting, trainees' group used the on-line instrument to simulate the group behaviour in stressful conditions. Each on-line game meeting was followed by an evaluation meeting led by a tutor who identified together with the participants the strengths and weaknesses of the game and suggested the changes in the behaviour and communication styles.

The evaluation methodology referred to post-testing questionnaires for participants to the test and interviews to tutors and companies' representatives. The instruments would be built to get an objective evaluation, without being influenced by the subjective perception of the tutors leading the test and which might be reproduced by another trainer which was not directly involved in the experiment. The data was gathered and analyzed according to the good practices for this type of study.

4. Conclusions

In brief, the project offered an innovative solution without competition, on the existing professional training market, which corresponds to a strong need of companies.

DECIDE-IT suggested a methodology based on role-playing as a fundamental element in developing soft-skills (e.g. training negotiations abilities).

TOL4FOOD- Transfer of knowledge and training for European traditional food producers related to innovative quality control methodologies[1]

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Abstract

TOL4FOOD is a Leonardo da Vinci Transfer of Innovation project which belongs to the Lifelong Learning Programme. TOL4FOOD's main aim is to promote cooperation and mobility between researchers and SMEs- traditional food processors from Romania, Spain and Portugal in the field of assessing the authenticity of traditional foods as a mean of improving the transfer of knowledge and good practices.

Keywords: traditional food, food processors, e-Learning, portal, lifelong training

1. Introduction

The TOL4FOOD project is funded with support from the European Commission - the Leonardo da Vinci Programme.

The Leonardo da Vinci Programme funds practical projects in the field of vocational education and training. Initiatives range from those giving individuals work-related training abroad to large-scale co-operation efforts. Innovation projects are essential to the programme; they aim to improve the quality of training systems by developing and transferring innovative policies, courses, teaching methods, materials and procedures.

The TOL4FOOD project (Transfer of knowledge and training for European traditional food producers related to innovative quality control methodologies) is an initiative of four partners from three countries:

1. The National Institute of Research & Development for Food Bioresources (IBA Bucharest, Romania)
2. SIVECO Romania SA
3. The National Technological Centre for the Food and Canning Industry (CTC, Spain)
4. Universidade Católica Portuguesa – Escola Superior de Biotecnologia (UCP-ESB, Portugal)

TOL4FOOD is a training program dedicated to researchers and SME-traditional food Romania, Spain and Portugal. TOL4FOOD promotes the cooperation and mobility between them, in the field of assessing the authenticity of traditional foods as a mean of improving the transfer of knowledge and good practices. There is little information about the precise composition of

[1] This project has been funded with support from the European Commission. This paper reflects the views only of the author and the Commission cannot be held responsible for any use which may be made of the information contained therein.

traditional foods. So, the investigation and registration of traditional foods contributes to the continuation of a nation’s culinary heritage and culture. The current situation regarding the traditional foods is similar in the participant countries (Romania, Spain and Portugal) in terms of the processors' need for assistance and training in: good food practices, food hygiene, food legislation (from January,1, 2006, the new food legislation adopted in EU imposes a very high pressure to the food SMEs to respect hygiene rules, EC No 510/2006 on the protection of geographical indications and designations of origin for agricultural products and foodstuff; EC No 509/2006n on agricultural products and foodstuff as traditional specialties guaranteed).

The DECIDE-IT project was funded with support from the European Commission - the Leonardo da Vinci Programme.

The Leonardo da Vinci Programme funds practical projects in the field of vocational education and training. Initiatives range from those giving individuals work-related training abroad to large-scale co-operation efforts. A significant challenge for traditional food production is to improve its competitiveness by identifying innovations that guarantee the safety of the products, while at the same time meeting general consumer demands and specific consumer expectations and attitudes towards traditional food (European Research on Traditional Food, EC, DG_Research, 2007). Robust methods for authenticating traditional foods are essential as part of scaling-up production and retaining the foods characteristics - its ‘’typicality” (European Research on Traditional Food, DG_Research, 2007). This project will be an opportunity for SME’s to improve their awareness of the need for innovation.

2. Objectives

Tol4Food proposes a transfer of innovation across countries (**geographic dimension**) and across sectors (**sectoral dimension**). As regards the **geographical dimension**, the project was developed by a network of four partners (from Romania-two organizations, Spain and Portugal). The training activities foreseen will be developed by all partners. All the documents will be translated in each member language, bridging over possible differences due to geographical locations, culture, education, technology, etc.

The most part of the project will ensure a transfer of innovation from Spain and Portugal to Romania:

(1) in the same activity sector: traditional foods processing, quality, legislation etc.

(2) from the West to East European countries.

Partner from Spain (CTC) will transfer to Romania knowledge and experience in: innovative food technologies valuable for improving process or making new products; specialized training in good manufacturing practices in innovative processes; training materials (leaflets or short manuals) on each technology, according with the European legislation; information on the food analysis necessary by law to guarantee its safety; food companies cluster organisation (a regional innovation system characterised by local initiatives); participating in national and international projects and funding opportunities; case studies demonstrating the benefits of R&D for food industry. Partner from Portugal (UCP) will transfer to Romania its experience from previous involvement in European projects (as TRUEFOOD, Guideline on effective technology transfer activities to SMEs in the food sector with particular focus on traditional food manufacturers) were it was in charge with the Training Programme for SMEs organizing training seminars in the topics: “European legislation on food quality and safety” and “Food quality control”.

As regards the **sectoral dimension**, the project concept was developed taking into account the features and needs expressed by the traditional food processors sector. They have difficulties arisen from the adoption of the new European food legislation for all the food producers, with specific recommendations for hygiene conditions, processing and quality control of the final products. Therefore Tol4Food aims to develop and to implement an integrated system for training and life long learning and to promote cooperation and mobility between researchers and SMEs-traditional food processors from Romania, Spain and Portugal.

3. Implementation

The Lessons component defined in the context of the collaborative environment will provide an efficient method by which users may assess concepts regarding traditional food specifications and processing techniques. The content development will also follow the concepts obtained from the development of the learning methodology and will address specific pedagogical characteristics and needs: raising the student's interest, active involvement, stimulates cooperation between course attendees, multi sensory stimulation in information presentation, interactivity. The Lessons module will provide instructors functionalities for organizing courses and achieving the learning objectives. The functionalities within the reach of the instructor will allow the definition of a specific order of lesson's moments (flow control), lesson formatting and composition, access control, evaluation forms, trainee's feedback. The collaborative platform will enable users to interact and will consist in a portal that will allow individuals to find information regarding recommendations, regulations and announcements about Traditional Food. It will enable users to share their experience, ideas and to disseminate information that will help building strategies that will assist users achieving their common goal: traditional food preservation. The collaboration platform will be organized in two sections:

- public section accessible to all users with access to the current legislation in the traditional food domain, current initiatives, news, announcements, surveys, outcomes of different actions and surveys, and other relevant information. A separate calendar module will contain information about public events related to Traditional Food

- private section accessible only to registered users, will enhance the user experience with powerful collaboration tools:

- Messaging and Communication–the portal will enable communication between users synchronous (instant messaging) or asynchronous (email).
- Information exchange–the portal will enable exchange of ideas, documents between users using the forum embedded into the portal, users can hold conversations over the internet.
- Social interaction–portal users will be able to share their experience to all other users or to public users using blog module

A relevant education is more important today than ever because today's world demands a workforce that understands how to use technology as a crucial tool for productivity and creativity. These skills include "information reasoning", a process in which reliable sources of information are identified, effectively accessed, understood, contextualized, and communicated to colleagues. Furthermore, employers require workers to have the skills necessary to collaborate, work in teams, and share information across global networks, that is, to analyze issues from a multidisciplinary perspective. Because these networks are international, employers seek out individuals who have the capacity to effectively interact with others.

eLearning has become a key adjunct to the actual world. The traditional educational institutions (schools, universities, lifelong formation) use it to prepare learners adapted to the society needs, organizations use it as a powerful strategy to better leverage their intellectual capital and to create new skills and increase performance in their employees.

To be successful in the emerging e*Learning Space*, however, we had shifted our thinking from designing relatively static distance learning solutions (such as class-room extended, course-based experiences, and reconfiguring existing courses and content resources) to digital, interactive, reusable objects that can be used in different virtual spaces, in multiple scenarios and instructional sequences. The challenge calls for highly personalized learning solutions that help learners respond to their defined needs and allow them to manage their own learning experiences.

Better trained personnel has emerged as one of the major challenges for the global knowledge society, and the solution for it is lifelong training. The previous notions of a divided lifetime of acquiring knowledge (in school and universities) and applying knowledge (in working life) have become untenable. Professional activities are knowledge-intensive in a continuously changing Europe. It cannot be expected for the workforce to acquire all the knowledge needed for a lifetime in advance. The half-life period of knowledge keeps decreasing and thus lifelong learning has become integral part of work activities in the form of continuous engagement in acquiring and applying knowledge and skills in the context of a current task at hand.

The new geographic boundaries of Europe impose a new concept of union, the union seen as a global assignment at an economical, social, and partly political level, a legislative harmonisation done for different cultural environments.

The accent is therefore on the optimisation of the European Union through structural laws, but also on maintaining a cultural independence of each and every country.

Based on these new approaches our project will apply an innovative framework of ideas in the field of professional learning for multicultural and multi languages environments. Summarizing this framework we can say that productive learning must be done in the local language and needs a learning by doing environment where learners make things collectively, tackling real problems, where they can share ideas with others, where we help them to reflect on their projects and assumptions, where lecturing felicitously complete learning by doing giving learners the knowledge they need to perform the activities that are the core of their daily work.

Our eContent and content design is focus on providing adult, individual learners with the tools, resources, and tactics for achieving their specific learning/training outcomes. An intermediary step has been for our instructional designers to emphasize the reconfiguration of traditional, classroom-oriented instructional and training experiences to digital, online versions of the same. At this moment the stake has changed, we no longer want to copy the traditional learning but to apply a new theory of “eLearning” bases on two important aspects: what the IT&C offers as learning means and resources and what are the new competencies and objectives of the eLearning process to be added to those of the traditional learning.

Our solution offers not only knowledge, information, communication, interactivity but also a friendly virtual environment, a place for changing experience, and a community to belong to.

The elearning tools can provide individualized, personalized learning by profiling variables such as interests, learning and cultural styles, presentation preferences and performance requirements. They can diagnose skill gaps and prescribe professional development activities ensuring the link between learning events and on-the-job practice. Individuals can monitor their own progress and determine what the next step in their professional development should be. Learning resources, ranging from individual objects to online communities of professional practice can be available when and where the learner needs those resources.

The cognitive strategies used in the developed courses are open, heuristic, problem oriented. They are complementary to acknowledged instructional algorithms, while the active-participative methods used contribute to develop in learners’ abilities, skills, attitudes and behaviours and not only mere memorizations of information or behavioural routines.

The variety of materials is the necessary support for an efficient instructional practice, where the learner takes an active part in the construction of his/her own learning process, is permanently required to provide feedback and to take decisions.

The process of understanding the notions relies on methods defined by interactivity, cooperation, communication. The degree of assimilation and understanding of the notions is definitely superior to the degree achieved by classical instructional methods, since the whole process is aimed at forming a structure in which the learner is meant *to learn how to learn*, the accent being on the development of the critical thinking.

4. Conclusions

A major benefit of such curriculum presentation is the possibility to transform a virtual reality into an instructional environment. This environment makes it possible to have activities that could never take place in a classical learning environment: experiments, simulations of processes or phenomena, virtual tasks modelled after real situations that learners face at their work places.

Trainings were organized in the foreign partners countries where IBA specialists participated in order to use the experience in Romania in the training which has been already organized in September with the SMEs and in the training which will be organized in October as 2 workshops, as follows:

- One workshop organized by IBA for students and professors from at least two scholar groups with specialization in food control/safety/technology;
- One workshop organized by IBA for professional groups as the Economic Administrative Mircea Vulcanescu School Group and the Technique College for Food Industry Dumitru Motoc.

Besides the face-to-face component, the training has also the on line part, which consists in taking the on line courses by each participant, due to an account created. Each participant communicates their email address and receives a user and a password, which allows them to access the on line courses. Additionally, there is the chance to follow each student’s activity and make different reports to analyze their on line activity.

S e c t i o n

SOFTWARE SOLUTIONS

Software Solutions (SOFT):

- **New software environments for education & training**
- **Software and management for education**
- **Virtual Reality Applications in Web-based Education**
- **Computer Graphics, Web, VR/AR and mixed-based applications for education & training, business, medicine, industry and other sciences**
- **Multi-agent Technology Applications in WBE and WBT**
- **Streaming Multimedia Applications in Learning**
- **Scientific Web-based Laboratories and Virtual Labs**
- **Software Computing in Virtual Reality and Artificial Intelligence**
- **Avatars and Intelligent Agents**

Using Web Service in Mobile Learning Environment

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Abstract

Web services are used to support interoperability between multiple devices on a network. Because standard allowed by web services can be used both for traditional computers and mobile devices. Thus web services provides access to a database of several types of devices and different types of applications.

Mobile applications running on devices with low memory and processor weaker than the traditional computer. Using web services for processing with high energy is required for mobile devices.Using mobile devices has grown lately due to its ease of use and access to information regardless of location and time. Access to information is done through web services because they have low power consumption and, also require a minimum data transfer via the Internet sing the XML standard. In this paper web service developed for mobile learning application is presented. The model of using web services in a mobile application is shown on a prototype developed in Learning Environment.

Keywords: Web Service, M-Learning, Mobile Application

Mobile Applications

The mobile application is a set of coded instructions used by a mobile device to solve a problem. Mobile applications have seen a huge diversity lately due to the fact that mobile phones have become the most used electronic devices.

According to (Popa, 2013) mobile applications are of three types according to the way of development:

- native applications are developed in a specific language of platform installed on mobile device used; these applications are dependent on the platform and the SDK have been developed and have access to all the device's hardware resources because they are developed with developer tools provided by the platform or operating system of the mobile device;
- web application developed to be run on a server and accessed by mobile devices via browsers, it provides limited access to the device's hardware resources and are available only online; another benefit of these applications is that they are accessible from any device regardless of platform or operating system, mobile device installs a browser and access the application via the web; web applications for mobile devices differ from traditional web applications through the presentation of information; these applications are developed for devices with small screens and minimal data entry;
- hybrid applications developed in native code for mobile devices and using certain modules developed on a server; processing power is shared between the server and the mobile device; these applications allow the use of hardware resources like a native application and also allows the use of high processing power of remote servers; creating links between modules native and web application developer written modules to be integrated, (Zamfiroiu, 2012).

In (Ivan, 2013) others typologies of mobile applications in terms of information criteria used for solving the problem are presented in detail.

In (About, 2013) the evolution of the number of applications owned by Apple AppStore is presented, table 1.

Table 1. Number of apps available on AppStore

Year	Month	Apps number
2008	July	800
	September	3000
2009	March	25000
	April	35000
	June	50000
	July	65000
	September	85000
	November	100000
2010	January	140000
	April	185000
	May	200000
	June	225000
	September	250000
	November	400000
2011	March	350000
	June	425000
	October	500000
2012	April	600000
	June	650000
	September	700000
2013	January	775000

Like in an alert way increase the number of applications on the other platform for the sale of mobile applications like Google Play or Windows Marketplace.

Mobile Learning Environment

Training students for college is based in part depending on the specialization and year of study. The traditional way training is performed at the university, in the laboratories where teachers and students are meeting face to face.

Due to technological developments have emerged new ways and new models of training. In (Dumitrache, 2012) five generations of training models are presented:

- model by correspondence courses involves printing and sending them by post to the students that they will see after receipt; will complete all tests and send them by post to teacher, (Musuroi, 2011);
- multimedia model involves sending mail all materials, but this time in addition to rates reported and printed CDs in electronic materials, and the student has a computer-assisted interactive learning (Dolores, 2008), (Tarawneh, 2011);
- tele-learning model, involves the development of audio and video conferencing through which the communication between student and teacher, (The Efficiency of Telelearning, 2013);
- flexible learning model is characterized by the interaction in the online environment, access to resources via the Internet and specific means of communication online;
- smart and flexible learning model is characterized by interactive multimedia online automated communication and access to resources in the virtual environment.

In addition to these new training model that is popular intelligent mobile and flexible learning to students who want to have access to information regardless of time and space. This model is characterized by accessing the mobile courses. Figure 1 shows the mobile learning environment. They are developed for M-Learning Platforms.

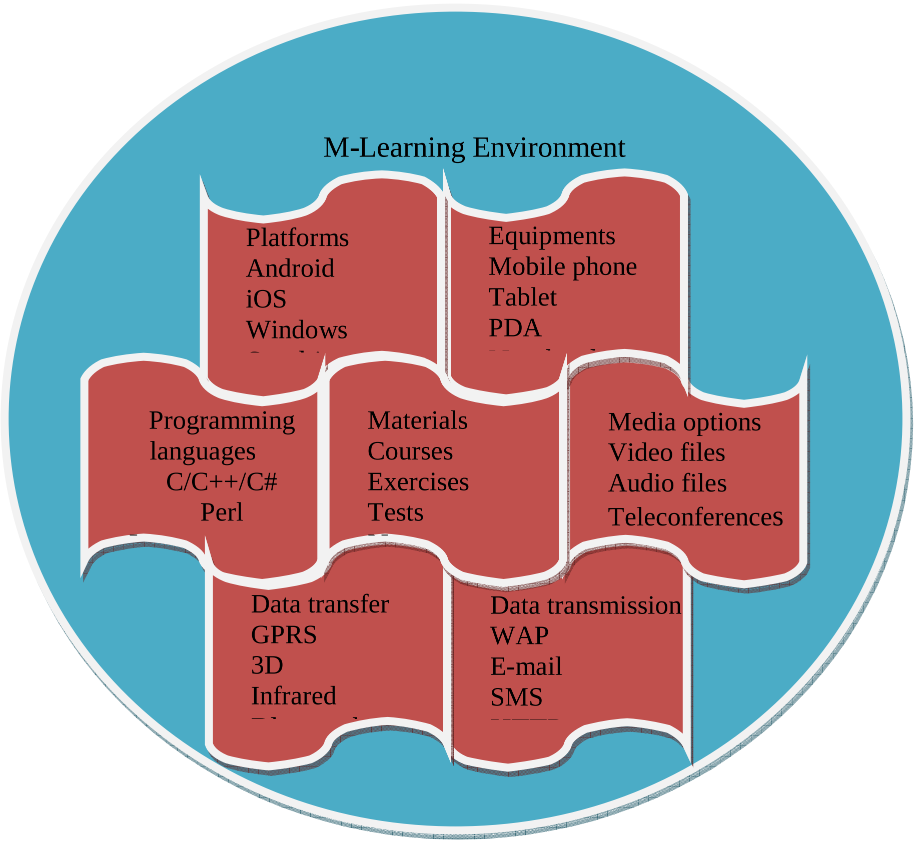

Figure 1. Equipment and technology used in M-Education

In Figure 1, the mobile learning environment is described.

Web Services

According to (Web Service Architecture, 2013) a web service is a software system designed to support interoperability between multiple machines or devices on a network. Web services represent a key component of SOA, Service Oriented Architecture, Figure 2.

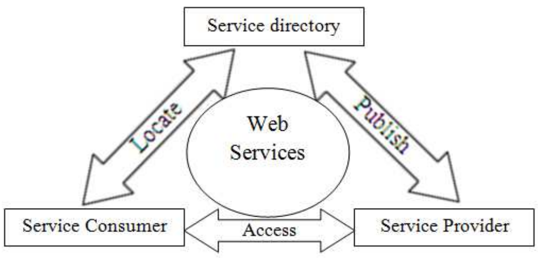

Figure 2. Service Oriented Architecture

Three main technologies were formed as web services standards. These are:

- SOAP provides a packaging structure for transporting XML documents; they are packed and coded binding standards to unpack them so as to obtain the same information;
- WSDL is a standard that describes how to communicate via Web services The parameters are set input and output for web method;
- UDDI is the standard search web services.

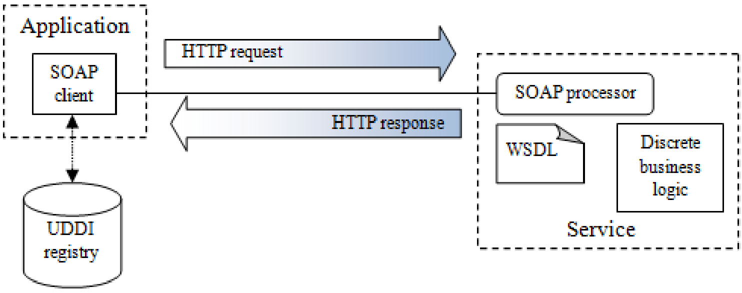

Figure 3. The interaction for a web service (Chappell, 2002)

In (Chappell,2002) is shown the interaction between the three technologies and established mutual relations between them, Figure 3.

Developed Prototype

For developing was chosen Android platform. As a database to SQL Server and especially the interaction between application and database is achieved through web services developed in C # programming environment using Microsoft Visual Studio 2010.

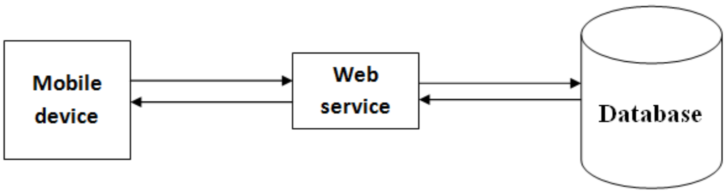

Figure 4. System architecture

Thus, the access to information in the database is done only through the web service, Figure 4. Web Service is regarded as intermediate level, a middleware for increasing the security and confidentiality of the database, because the access is done systematically and only necessary information is made available to end users.

The web service is done in C #. This includes methods that allow access to database.

Confidential information from the database, such as user password is not returned. Verifying the authenticity of the authentication will be performed on the server. The method receives a user name and password, and after checking it returns the user ID, password being returned. Web authentication method called the application is given below.

```
private int access(string username, string parola)   {
        String command = "SELECT id FROM mcs_utilizatori WHERE mcs_utilizatori.utilizator=@username and mcs_utilizatori.parola=@parola;";
        int idUtilizator = 0;
        try  {
           conn = new SqlConnection(connectionString);
```

```
            conn.Open();
            SqlCommand sqlCommand = new SqlCommand(command, conn);
            sqlCommand.Parameters.Add("@username",   System.Data.SqlDbType.VarChar,   50).Value   =
username;
            sqlCommand.Parameters.Add("@parola", System.Data.SqlDbType.VarChar, 50).Value = parola;
            idUtilizator = Convert.ToInt32(sqlCommand.ExecuteScalar().ToString());
        }
        catch (Exception ex)  {
            LogError(ex.Message);
        }
        finally  {
            if (conn != null)
                conn.Close();
        }
        return idUtilizator;
    }
```

In case there is an exception that is stored in a special table created by this method: LogError().

```
    private void LogError(String message)   {
        String command = @"INSERT INTO mcs_errori (message,data) VALUES (@message,@data)";
        SqlCommand sqlCommand;
        int result = 0;
        try   {
            conn = new SqlConnection(connectionString);
            conn.Open();
            sqlCommand = new SqlCommand(command, conn);
            sqlCommand.Parameters.Add("@message", SqlDbType.NVarChar, 50).Value = message;
            sqlCommand.Parameters.Add("@data", SqlDbType.DateTime).Value = DateTime.Now;
            result = sqlCommand.ExecuteNonQuery();
        }
        catch (Exception ex)  {
        }
        finally  {
            if (conn != null)
                conn.Close();
        }
    }
```

After publishing the web service web methods are available at the link: http://mcs.alinzamfiroiu.ro/service.asmx. For this, next steps are followed:

- have acquired the *alinzamfiroiu.ro* domain;
- has developed a web hosting account to store web service;
- have made a sub-domain: *mcs.alinzamfiroiu.ro*;
- from Visual Studio has made the publication of the new web service created;
- new web service published on the server has been moved to the appropriate folder sub-domain *mcs.alinzamfiroiu.ro*.

In this way one can achieve availability of any newly created web service, which is currently available at the address.

Conclusions

Technology evolves and develops at an alert rhythm. Such mobile applications grow and they in turn in a rapid rhythm. Until recently mobile devices were considered only cellular phones. Today, mobile devices are considered in addition to phones, tablets and glasses, such as GoogleGlass or smartwatches, that are at the design stage yet but soon will become reality.

Mobile applications will run on all of these devices and their number will increase rather than. This increase should not disturb the quality of mobile applications. Their quality must remain a factor in the choice decision maker of mobile application to be installed on any mobile device.

Educational environment adapts to the evolution of technology and integrate these new technologies give students the opportunity to access educational materials regardless of device, space or time. The materials are stored in a database server and the web services provide access to them.

Web services are accessible from any device and returns data in a standard format so that it is interpreted to be provided depending on the mobile device user running the application.

MCS application developed uses web service specifically designed for logging and profiling students. The web service will be further developed by adding new ways for students to access course materials from the database and evaluate the tests directly on the smartphone.

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Designing of Virtual Experiments for the Physics Class

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Abstract

Physics laboratories have their limitation with respect to equipment and measurement devices. In such circumstances, when the necessary technical resources are not available, some experiments are much harder to perform. The ones which can be performed are limited in terms of setup and the extent of concrete quantitative measurements. The solution to overcome these problems resides in the development of a virtual physics laboratory. Virtual instrumentation enables the setup of experiments that can cover a wide range of situations, complementing the domain of real experiments. In this article we will illustrate the creation of a virtual experiment for the determination of physical quantities using both the graphical programming environment LabView and the application MS Excel. Our focus was laid on the lesson „Alternative Current Series Circuit RLC", where we calculated and graphically represented the following physical quantities, depending on the frequency of the circuit power source: current (I), voltage (U), reactance (XL, XC), impedance (Z) and phase shift (φ).

Keywords: virtual experiment, series circuit RLC, Excel, LabView

1. Introduction

Recent studies in the field of physics education (Garabet *et al*, 2011; Munteanu and Logofătu, 2003) have shown that the holistic approach of physics experiments requires the inclusion of virtual instrumentation in their design and analysis. In such circumstances, setting up a virtual laboratory becomes imperative, as it would help extend the possibilities of a real laboratory which has a limited set of measurement and control instruments. In this paper we offer an example for designing a virtual experiment in the field of Electricity – The study of an alternative current series circuit RLC, where we configured the necessary virtual instruments with the applications Microsoft Excel and LabView.

2. Experimental design in Excel

From the Office Suite, MS Excel is the application which is based on table data. The application is commonly used in the physics class in order to process experimental data and store it in measurement tables. However, another way of using this application resides in designing virtual experiments, like the one we focused on in this paper. We will now describe the stages of the virtual experiment associated with the study of the alternative current series circuit RLC.

To start with, we opened the application MS Excel and, on the first worksheet (*Sheet* 1), we inserted the title of the virtual experiment to be undertaken: *The Study of a RLC Series Circuit.* From the *Insert* tab, we clicked on *Shapes* and selected a rectangular shape with round edges. On top of it we inserted other shapes in order to represent the symbols for electric circuit components which are part of a RLC series circuit. In a group of cells next to the representation of the circuit we introduced the mathematical expressions associated with the circuit reactances (*XL* si *XC*), impedance (*Z*), resonance frequency (*r*) and the current going through the circuit depending on the impedance (*I*).

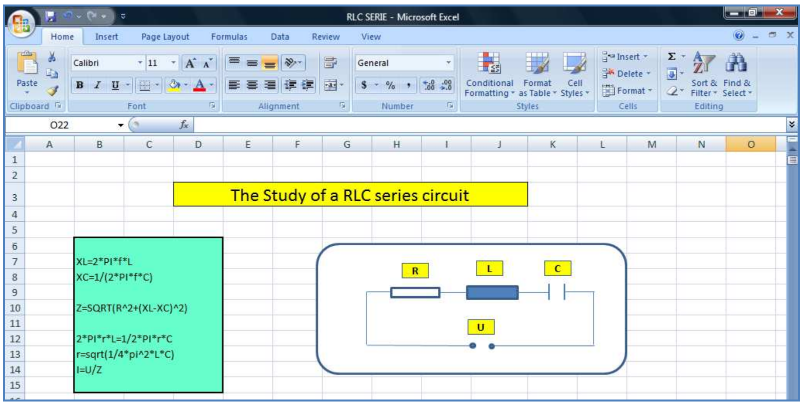


Figure 1. Creating the Excel virtual experiment

We associated incrementation buttons to the variable physical quantities *(U, R, L, C)*. In order to insert them into the worksheet we selected the *Developer* tab and from the *Ribbon* we clicked on Insert and from *Form Controls* we selected the *Spin Button*.

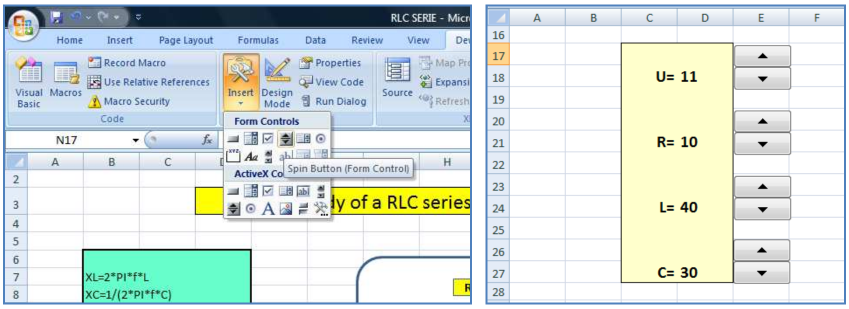


Figure 2. Creating Form Controls for the variables

Through *Drag and Drop* the buttons associated with the circuit variables were introduced in the worksheet, in the cells situated next to the values for the variables. The formatting of each button was performed by right clicking on its symbol, selecting *Format control* and in the opened window click on the *Control* tab. We selected *Cell Link* and by clicking on the arrow on the right hand side of the dialogue window, in the newly opened window we introduced the address of the cell in which the current value of the variable would be displayed. By clicking OK, the dialogue window closed and the new setting became active.

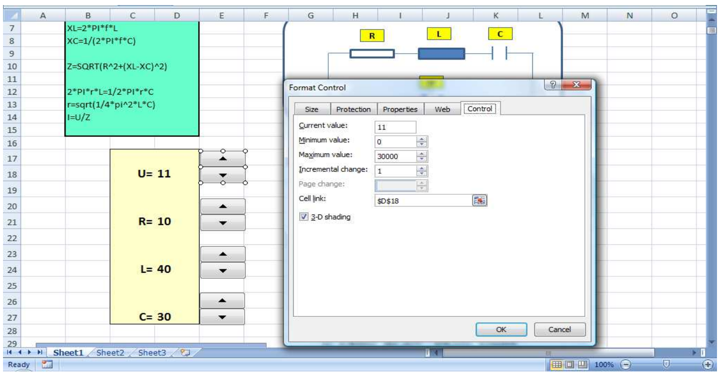
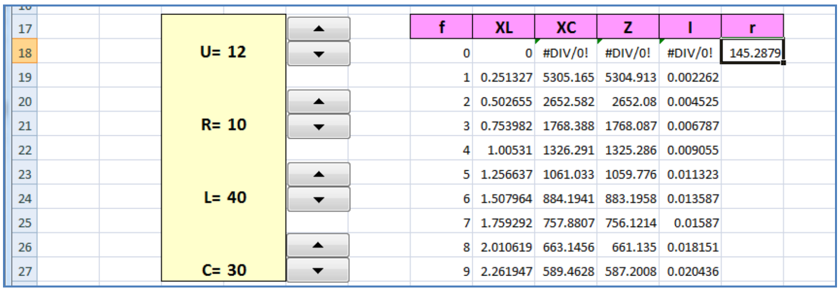


Figure 3. Formatting variable controls

We introduced in a group of contiguous cells (on the same row) the symbols of the physical quantities to be studied and in the area situated under these physical quantities the calculus of their values. In the column associated with the physical quantity f frequency we introduced values in the interval [0,1000], in order to draw the charts $X_L=X_L(f)$, $X_C=X_C(f)$, $I=I(f)$. We introduced, with the help of control buttons, values for the voltage U, the resistance R, the inductance L and the capacity C. Once the first values for X_L, X_C, Z și I were calculated, we completed the series of data from the columns by moving the pointer of the mouse over the area corresponding to the chosen frequency domain.



f	XL	XC	Z	I	r
0	0	#DIV/0!	#DIV/0!	#DIV/0!	145.2879
1	0.251327	5305.165	5304.913	0.002262	
2	0.502655	2652.582	2652.08	0.004525	
3	0.753982	1768.388	1768.087	0.006787	
4	1.00531	1326.291	1325.286	0.009055	
5	1.256637	1061.033	1059.776	0.011323	
6	1.507964	884.1941	883.1958	0.013587	
7	1.759292	757.8807	756.1214	0.01587	
8	2.010619	663.1456	661.135	0.018151	
9	2.261947	589.4628	587.2008	0.020436	

Figure 4. Calculated values

Drawing the graphics went according to the following sequence: we clicked on the *Insert* tab from the *Ribbon* and inserted a *Scatter chart* (XY Chart). Once the chart appeared in the diagram, we formatted the surface of the diagram, its axes, the data series from the graphic and the title of the diagram.

The following figure (Figure 5) displays a few graphics drawn starting from the following set of values:

U=12V, R=10Ω, L=40mH, C=30μF.

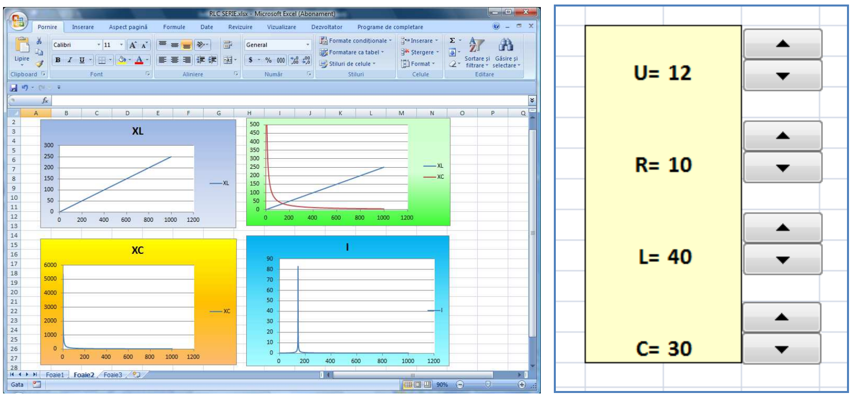


Figure 5. Resulted graphs for the values indicated on the right

For the values of the previously selected circuit components, the resonance frequency of the circuit was situated around the value of 145 Hz. This is easily noticeable in the graphical representation $I=I(f)$:

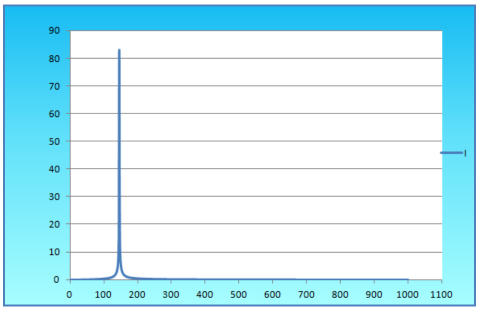


Figure 6. Graphical representation I=I(f)

f	XL	XC	Z	I	r
0	0	#DIV/0!	#DIV/0!	#DIV/0!	145.2879
1	0.251327	5305.165	5304.913	0.002262	
2	0.502655	2652.582	2652.08	0.004525	
3	0.753982	1768.388	1768.087	0.006787	
4	1.00531	1326.291	1325.286	0.009055	
5	1.256637	1061.033	1059.776	0.011323	
6	1.507964	884.1941	883.1958	0.013587	
7	1.759292	757.8807	756.1214	0.01587	
8	2.010619	663.1456	661.135	0.018151	
9	2.261947	589.4628	587.2008	0.020436	

Figure 7. Graph values

3 Experimental design in LabView

LabView is a graphical programming environment which can be used in physics education for the design of didactic materials of outstanding quality. The wide array of instruments it holds allows for the virtual experiments undertaken with this application to cover all the fields of physics. The graphical programming environment LabView has two windows – a Front Panel for the user, where all the graphical structures associated with experimental modelling are placed and a window called Diagram, where the logical scheme of the application is to be found.

In order to setup a virtual experiment for the study of the alternative series circuit current RLC using LabView we performed the following sequences. On the Front Panel we introduced a group of controls for the values of the physical quantities to be studied: frequency ν, voltage U, resistance R, inductance L and capacity C. Every control had a specific label attached and a digital display type of button for a precise display of the values of the measured physical quantity. Moreover, we placed a WAVEFORM GRAPH diagram on the Front Panel in order to visualise the graphs of the the instantaneous quantities of:

the current through the circuit: $i = i(t)$

the voltage on the resistor: $u_R = u_R(t)$

the voltage on the coil: $u_L = u_L(t)$

the voltage on the resistor: $u_C = u_C(t)$

We have to specify the fact that this type of GRAPH does not accept individual (scalar) values, but only rows of values (ARRAY). In addition, we inserted on the Front Panel two more diagrams in order to visualize the frequency dependence of the effective values of the current and of the reactances:

$$I = I(\nu),\ X_L = X_L(\nu),\ X_C = X_C(\nu).$$

On the right hand side of the *Front Panel* we placed the indicators for the display of the values of the physical quantities: impedance Z, phase shift φ, reactive impedant values X_L, X_C, maximal values for voltage ($U_{\max}$) and current ($I_{\max}$), actual values U_R, U_L, U_C, resonance frequency ν_{rez}, quality factor Q. All these physical quantities are placed in relation to specific measurement units.

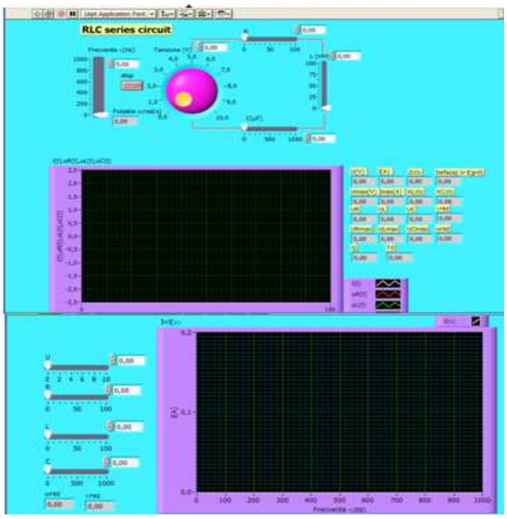


Figure 8. Front Panel

The diagram of the application is based on two formulae nodes, each included in a FOR loop, a repetitive structure with a fixed number of iterations (in this virtual experiment there were 100 and 1000 iterations for each loop). In order to watch the value shift of the physical quantities in real time, the two FOR loops were integrated in a WHILE loop. This is a repetitive structure with a conditional terminal. The WHILE loop executes non-stop the part of the diagram it contains until a stopping condition of the process appears, a logical value TRUE. The simulatenous display of the graphics for the instantaneous physical quantities was done by concatenating the array of values taken at the exit of a FOR loop by a BUILD ARRAY element, connected to a WAVEFORM GRAPH. The array of values obtained at the exit of the second FOR loop were assambled in the form of clusters through BUNDLE functions and concatenated through a BUILD ARRAY element, which sent them to a XY chart.

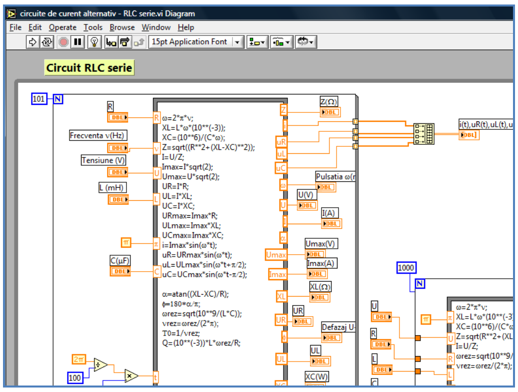


Figure 10. The diagram of the LabView application

In the following figures one can observe the results of an experimental simulation based on this project.

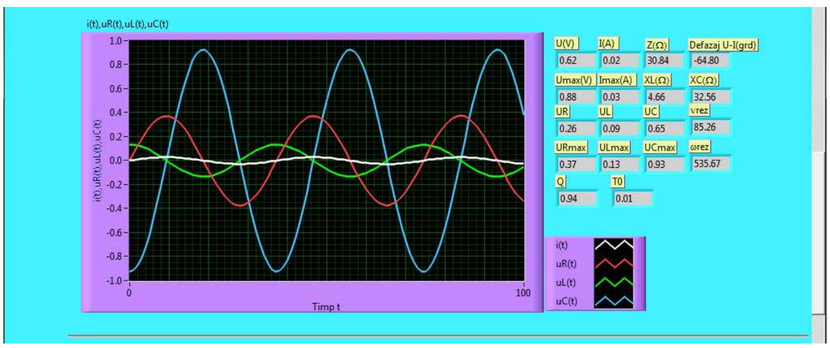


Figure 8. Graph 1

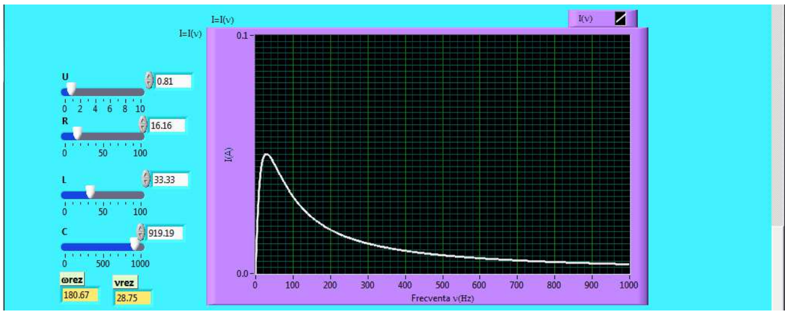


Figure 8. Graph 2

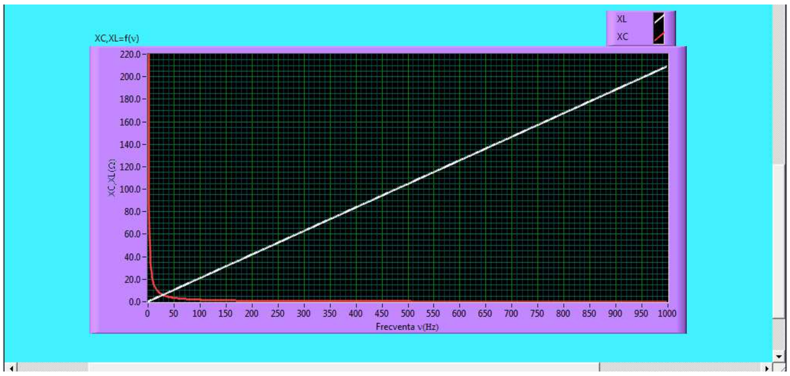


Figure 8. Graph 3

4 Conclusions

A teacher can use LabView and Excel to design classical virtual physics experiments, but also experiments which are quite hard to realize with the instruments of a standard laboratory. Designing virtual experiments is both a challenging and pleasant activity. The results give both the teacher who designs them and the students who easily perform them a high degree of satisfaction. From a didactic point of view, the graphical interfaces containing the virtual instrumentation create a pleasant atmosphere for the students and allow them to get used to the manner and rigors of scientific work.

Introducing virtual experiments in the physics class takes the didactic process to a whole new level of variety and understanding, desired by both teacher and students. All in all, the virtual instrumentation provided by LabView and Excel is able to give the classes a high quality level in terms of homogenity, integrality and diversity.

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An Interdisciplinary Approach to the Process of Heat Transfer through Computer Assisted Experiments

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Abstract

This experiment intends to use the notions regarding heat transfer in order to explain the control over the human body's temperature using an interdisciplinary activity between Physics and Anatomy. The usage of the computer assisted experiments enable the teacher to combine the traditional teaching methods with the interactive modern ones. By doing this, a favorable studying environment will be created in order to help students comprehend complex concepts and apply this knowledge in real life experience.

Keywords: Computer assisted experiments, Interdisciplinary activity, Physics, Heat transfer.

1 Introduction

During the process of maintaining a constant temperature, the processes through which the human body transfers and receives heat from external sources are very important. If the body temperature is higher than the one of the external environment, heat is released through conduction, convection and radiation. If the external environment temperature is higher than the body's, the body will receive heat through radiation as well as conduction (Hall, 2010). In this way the skin is either warming or cooling enabling the heat transfer from/to the internal tissues. If the outside temperature is high, the human body sweats and releases heat which help within the process of evaporation (Enescu, 1984). The evaporation of the sweat from the tissue is one of the most important processes used by the human body to control its temperature (Hall, 2010). The quantity of sweat which evaporates from the skin depends on the temperature of the surrounding environment, humidity and the speed of air. Evaporative cooling is more efficient within a windy dry environment than in a hot day when the humidity is at a high level (Davidovits, 2008). This higher level of humidity reduces the water evaporation from the skin. On the other hand, a low level of humidity can lead to a dehydrated skin and dry mucous membranes (Giancoli, 2007). Due to the direct contact between the human body and the external objects such as clothes or food, a little part of the heat is exchanged by the body with the surrounding environment through conduction (Enescu, 1984). If we hold in our hands a piece of ice, we will have a cold feeling because the heat is transferred from hand to ice (http://www.docstoc.com/docs/32963758/Heat-Transfer---PowerPoint). Taking into consideration that the air conductivity is at a low level, the heat that is transmitted through conduction by the air kept tight around the skin by clothes is also very low (Enescu, 1984). The heat transfer through conduction is done between regions that are at different temperatures. The direction of heat flux is always indicated from the region with high temperature to region with low temperature. The rate of heat transfer through conduction is given by the formula [1]:

[1]
$$H = \frac{dQ}{dt}$$
$$H = k\,A\frac{T_1 - T_2}{L}$$

where k represents the thermal conductivity.

Human body can also release heat through convection. If the body is exposed to wind, the layer of air which is closest to the skin is replaced by a new layer of air which is cooler. In this way, the heat lost through convection increases correspondently. The rate of heat removed through convection is proportional to the exposed surface area and the difference of temperature between skin and the ambient air. The rate of heat transfer through convection is give by the formula [2]:

[2] $$H_C = K_C A\left(T_1 - T_2\right)$$

where A represents the exposed area of the convection currents, T_1-T_2 represents the difference between the considered surface and the convection fluid. K_c represents the convection coefficient (Davidovits, 2008).

If an object that has a T_1 temperature is placed in an environment which has a temperature $T_2<T_1$, the net energy lost by the body is given by the formula [3]:

[3] $$H_r = e\sigma\left(T_1^4 - T_2^4\right)$$

where *e* represents the surface emissivity that depends on temperature and the nature of surface, *σ* is Stefan Boltzman's constant (Davidovits, 2008).

During cold days of winter, the clothes keep the air close to the skin in the clothing fabric, so that the convection flux of air currents decreases (Hall, 2010).

Given the fact that water's specific heat is greater than the air's, it is impossible for a body to heat a thin layer of water in order to create an isolated area as it happens in the case of air (Hall,2010). Because the water has the specific heat greater than the air's it will be impossible for the body to warm a thin layer of water in order to form a non-conducting area, as it happens in air. The rate of heat loss in water is much higher than the rate of heat loss in air (Hall, 2010). This is the reason why the efficiency of the wet clothing is almost inexistent in maintaining the body's temperature, the higher conduction of the water raising the rate of heat transmission from the body to the exterior medium (Hall, 2010). All the phenomena which can be observed in the daily life are used in the current study in order to explain the way in which the notions connected to the heat and temperature transfer can be used to explain the adjustment of the body's temperature. These phenomena are explained based on computer experiments and activities involving the interactive whiteboard. To achieve these experiments, we used the COBRA 3 system of acquisition and data processing provided by Phywe System GMBH & Co.KG (Germany).

2. Interdisciplinary approach to the process of heat transfer through computer assisted experiments

This experiment was inspired by the series of experiments by Pasco Scientific Company (USA) (http://www.pasco.com/experiments/biology-through-inquiry/regulation-of-body-heat.cfm) .

During this computer assisted experiment, a temperature sensor will be fixed above the hand. The hand with the temperature sensor fixed above the hand is held during one minute in air, and then it is introduced in a bowl of water and ice, being half for one minute, after which it is taken out and held in the air. The second temperature sensor registers the temperature of the environmental air. Figure 1 shows this experiment.

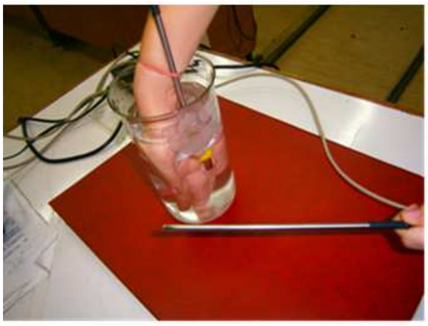

Figure 1. The hand with the temperature sensor fixed above the palm introduced in the mix of the ice and water.

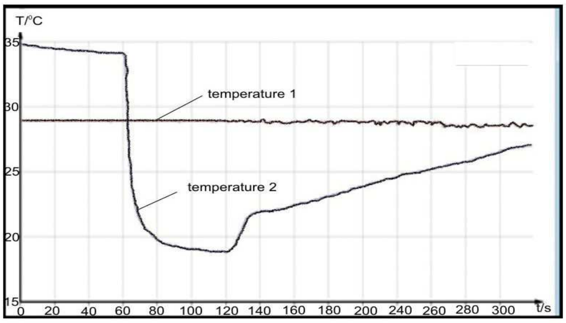

Figure 2. The variation of the temperature of the environment depending on time and the temperature registered by the sensor fixed on the hand introduced in the mix of water and ice

Figure 2 shows the graphics of the temperature of the environment and of the air above the hand while it is in the air, then introduced in the bowl of water and ice and then again in the air.

It is noticed that the air temperature above the hand is nearly constant for a minute, while the hand is held in the air and equals 35^0C, then the temperature sensor indicated a drop in temperature down to nearly 20^0C during 10 seconds just as the hand was introduced in the bowl with the mix of ice and water. Subsequently, the temperature drops slower down to 18^0C for 20 seconds and one minute later, after the hand is taken out , the temperature starts rising up to 28^0C during 160 seconds, the temperature of the environment being held constant and equalling 30^0C.

From the analysis of this experiment, the conclusion is that it is impossible for the human body to heat a layer of water close to the body, in order to form an insulating layer like in the case of an air layer (Hall, 2010). Wet clothing conducts heat better than dry one. Because of that, it is suggested to change clothes if they are wet, for example after it rains.

During the following experiment inspired by the experiments conducted with the help of data logger Fourier (http://www.fourierdataloggers.com/usb-link-and-multilog-pro.html), it is intented to emphasize the loss of heat lost by the body through the evaporation of the sweat and the state of discomfort of the body in the hot days with a wet atmosphere.

The experiment is being conducted using two mugs of clay. In both mugs the water is introduced at the temperature of 70^0C, then it is covered by an isolated lid provided with a small hole in which it is introduced a temperature sensor which will record the temperature of the water inside the mugs. One of the two mugs is introduced inside a plastic bag which is going to be tied. Inside the bag it is introduced a data logger which will record the temperature and relative humidity of the air inside the bag. The other mug will be let in the environment in which will be recorded the relative humidity of the air.

Figure 3. Experiment which can show the heat loss by water evaporation inside the unglazed clay mug

For 10 minutes it is recorded the temperature and the humidity in the specified conditions and then the bag is untied being measured the temperature and the air humidity inside the bag for 10 minutes.

Figures 3 and 4 show the aspects during the experiment.

The graphic from figure 5 shows the time variation of the water temperature inside two mugs.

Figure 4. The steamed bag during the experiment

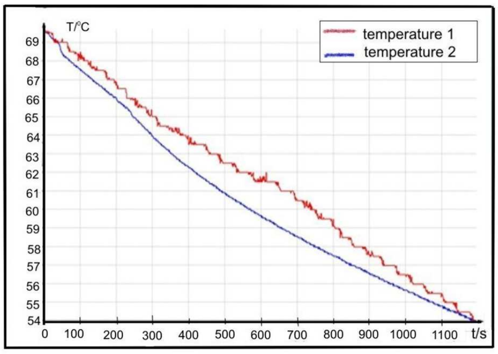

Figure 5. The variation of the temperature of the water from the two unglazed clay mugs depending on time.

For the mug enclosed inside the bag we observe that in 600s the temperature of the water decreased from 70^0C to $61,5^0$C, while the temperature of the water inside the mug let in open air decreased in the same period of time from 70^0C to $59,6^0$C. The temperature of the water inside the closed mug inside the bag decreased by $8,5^0$C, as long as the bag was closed, and the temperature of the water inside the mug let in open air decreased in the same period of time by $10,4^0$C. After the bag was opened, the temperature of the water inside the mug which was initially inside the bag decreased from 61,5 ^{0}C to 54^0C for 600s, and for the water inside the mug let in open air, the temperature decreased from $59,5^0$C to 54^0C. After opening the bag, the temperature of the water inside the mug which was initially in the bag decreased by $7,5^0$C, while the temperature of the water insinde the mug let in open air decreased by $5,5^0$C in the same period of time. The rate of heat loss is bigger than in the closed mug inside the bag as long as it was closed than in the case when it was free. In the first ten minutes, we observe that the heat loss rate is bigger in the case of the water insinde the mug let in open air, than in the case of the closed mug inside the bag. The graph of the variation of the air temperature from inside the bag is shown in figure 6.

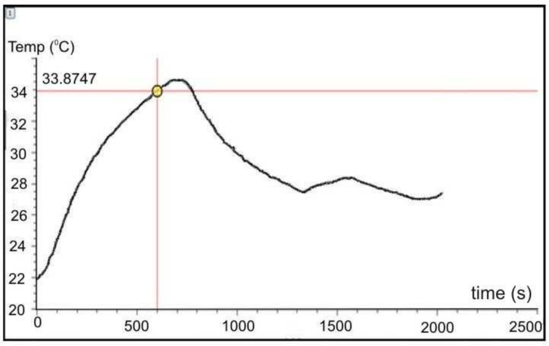

Figure 6. The graphic of the variation of the air inside the bag depending on the time

From the graph we can observe that the temperature of the air inside the bag increases from 22^0C to 34^0 C for 10 minutes while the bag was closed, and after that it decreases to $27,2^0$C until the end of the experiment. Figure 7 shows the graph of the variation of relative humidity of the air inside the bag depending on time.

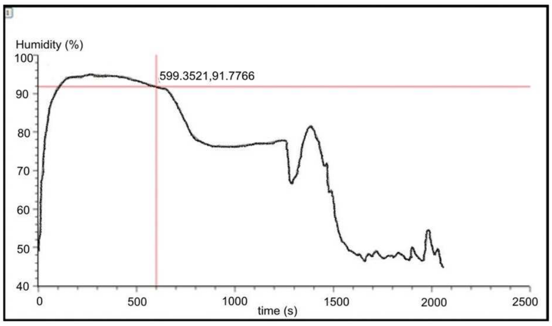

Figure 7. The variation of the relative humidity of the air inside the bag depending on the time

From the graphic above we observe that the relative humidity of the closed air from the bag increases from 44,81% up to 95% in 10 minutes, after that it begins to decrease after the bag was opened. In the first part of this experiment, while the bag was closed, both the temperature and the humidity of the air inside the bag increased. In the same time we observe that water drops appeared on the bag and on the mug. The mug is made of unglazed clay. Clay is a porous material which contains small holes which cannot be observed with the free eye. When the water is introduced in the interior of the mug, the water flows through these holes and gets the whole mug wet. Because the environment inside the bag is warm, due to the closed air, the water inside these holes will evaporate. The increased temperature favors the increase of the relative humidity of the air. This can be observed by the increase of the relative humidity inside the bag. The relative humidity represents the rapport between the partial pressure of the water vapors and the pressure of the saturated vapors at a given temperature. The relative humidity of the air increases until it reaches an atmosphere saturated with water vapors, when the evaporation stops. For this reason water drops appear on the bag and on the mug. When the mug yields heat for the evaporation of the water, it lowers its temperature compared to the initial temperature. Figure 8 shows the image of the bag in which we can observe the water drops.

Figure 8. The bag in which we can observe water drops

3. Conclusions

The lessons in which the subjects are approached interdisciplinary proved to be more attractive for students, as they were more focused on their research especially because they looked for information that is not taught at school. Moreover, the students could easily make connections between physics and other subjects such as anatomy.

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On The Evaluating the Personnel of an Air Quality Monitoring Network Using an Agent Based System

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Abstract

Most developed countries have set up laws and developed air quality measurement networks to monitor pollutant concentrations, and issue warnings when acceptable levels are exceeded. Designing efficient air quality monitoring networks have become one of the current challenges for the research communities from the control engineering, electronics, environmental engineering, power industry, and artificial intelligence fields. The high complexity of the whole monitoring network knowledge management system, that is also a distributed system, can be handled by using a multi-agent system. Through communication and cooperation the agents are solving different problems specific to knowledge management in a monitoring network. The periodic evaluation of the personnel involved in this process can be done as well using a multi agent system. This paper presents EvalMAS (Evaluation Multi Agent System) a peer to peer agent based system that is used in this scope. The system is developed using Zeus, a toolkit for multi agent system development.

Keywords: Evaluation, Multi agent system, Air quality monitoring network

1. Introduction

Air pollution is one of the major environmental problems in developed countries as it has a great impact on human health (K¨ unzli et al., 2000; Lipfert et al., 2000; Pope et al., 2002), visibility (Cheng and Tsai, 2000; Trier and Horvath, 1993) and global climate. Being aware upon the human negative effects of the air pollution there were implemented air quality monitoring networks in order to evaluate at each moment the concentration values for the major air pollutants. In Romania there is the National Air Quality Monitoring Network which consists of 117 stations placed in 37 counties for monitoring the influence of the traffic, industrial activity and urban settlements over the air quality (Calitate aer, 2013). The measurements are made hourly, at each station, and after a primarily validation they are stored in dedicated databases. The data are also published online for the population information regarding a possible pollution episode.

In order to have a monitoring network that works properly, a personnel periodic training and knowledge evaluation is needed. The knowledge evaluation can be done either in the traditional way (each human resources responsible meets each employee and tests him/ her) or using an online method.

In this paper it is proposed an online agent based evaluation system for the all employees. One of the advantages of this system is that it reduces the cost related to the people shifting, the evaluation being able to be made from a long distance.

2. Agents and Multi Agent Systems

A software agent has some special characteristics such as: cooperation, autonomy, ability to communicate, and reactivity. Thus a multi-agent system closely resembles a community of human beings doing business with each other while each one of them has one or more predefined goal (Weiss, 1999).

Social ability of an intelligent agent is the ability to interact with the other intelligent agents in its environment. An intelligent agent is reactive if it is able to recognize any changes in its environment and react with corresponding actions based on the changes and the goal of the agent. Pro-activeness of intelligent agent displays goal oriented behaviours. (Segura et al, 2013).

3. EvalMAS implementation

To investigate the efficiency of an online personnel periodic evaluation, a multi- agent system is implemented to provide a testing platform of the proposed model. The whole system is written using Zeus, a Java-based toolkit for intelligent agents. Zeus allows portability, which is assured by the use of Java, and defines an agent platform that may be distributed across a network.

EvalMAS is designed as an agent-assisted employee examination for online examinations that provides the test score by taking into account the number of the correct answers given by the personnel. If a minimum correct answer is given for the test to be passed the system congratulates the user, otherwise a warning is displayed and the test should be taken again in maximum 2 weeks.

For this version there were designed three intelligent agents, each one placed on a different computer. Therefore, three computers located in three different places in the Petroleum-Gas University of Ploieşti were used. Figure 1 shows the university campus and the locations for this wired local computer network.

All these three machines reside at the Department of Information Technology, Mathematics and Physics, at the Petroleum-Gas University of Ploieşti. All the machines have different hard drives, but the same set of files created with Zeus is shared on every one of them. This is to ensure that all the related initialisation and configuration file are accessible from every machine.

On the computer A is located the Supervisor_Agent, the intelligent agent that initiates the communication between the agents in order to collaborate to achieve the system goal. For that, the other two agents, Local_Agent1, placed on the computer B, and Local_Agent2, placed on the computer C search their own databases for the needed data and send them to the Supervisor_Agent.

The protocol TCP/IP is used to transfer data in our system. It uses packet switching to transmit data between the computers A, B, and C. When the packets reach their destination, they are reassembled in the proper order. The version of IP used is Internet Protocol Version 4 (IPv4), which uses 32-bit addresses [16]. For example, the computer A IP address is 10.0.0.210 and it shows that this computer is in the subnetwork of the building E. The other two computers are located in building J and have the IP addresses 172.16.21.107 and 172.16.21.110.

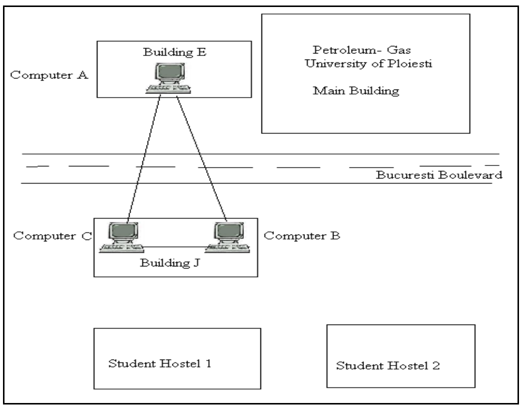

Figure 1. *The physical locations of the intelligent agents*

3.1 Data set

The EvalMAS environment is composed of several databases. There is a tests base, as well as the datasets produced during the previous tests executions by the each employee. In the tests database there are stored several versions of the each type of tests (hardware knowledge test, software knowledge test, standards tests, legislation tests, information for each major air pollutants tests etc). Each version is completed with the correct answer for each question. The periodic results for each employee for all test types are recorded in a special database.

4. Experimental results

The Supervisor_Agent initializes the agents' communication asking the other agents to provide the recorded data for a certain employee and a certain type of test, selected from the interface presented in fig. 3. In this case study, the chosen employee is Ionescu Ion and the test given is for major air pollutants. To achieve this goal, the local agents work jointly with the supervisor agent, by sharing the same ontology and assisting each other when it is performed a general report on the employee knowledge quality.

Thus, the agents extract the information from two MySQL databases, one for the tests, using a random selection of the test version, and the other one provides the last year results of this employee for this test type. Once extracted, the information are presented in a special report to the test monitoring responsible which centralizes them for correct answers analysis and then displays the results to the user. These agents' interactions are drawn in figure 2.

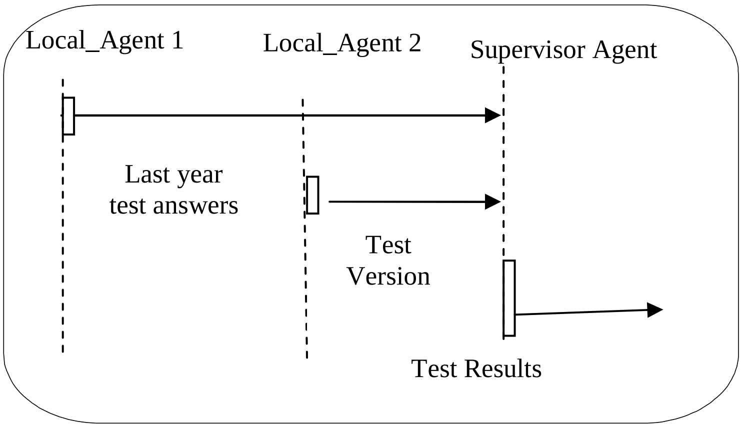

Figure 2. The interaction diagram between the agents of EvalMAS System

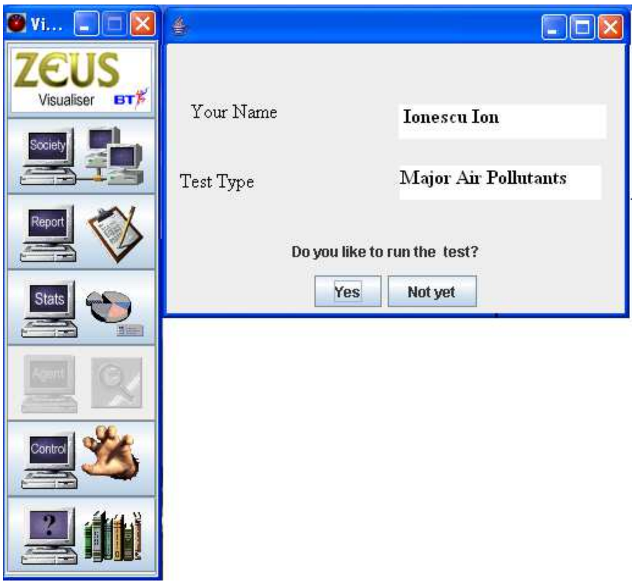

Figure 3. The EvalMAS system interface during run

The collaboration between agents can be seen in figure 4, in the Agents Society with the messages exchanged between agents.

After running the application the results are displayed. It can be noticed that there are 9 out of 10 correct answers, and for this type of test this employee has passed all the last year quarters tests.

There can be generated a series of statistics related to the collaboration, inter-agent traffic volume, the distribution by type or by agent of the traffic volume. In figure 6 it is presented the breakdown of the agents by type: each one of the agents Nameserver, Facilitator and Visualizer represents 17% of total number of system agents.

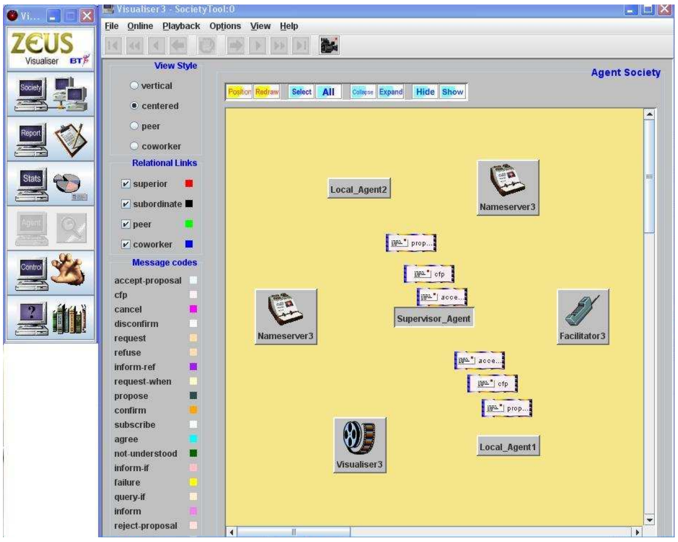

Figure 4. The Agents Society of EvalMAS System in Zeus

The Nameserver and Facilitator agents are essential for the system because they are the ones who know the IP addresses and tasks that can be performed by each agent individually. The Visualizer agent is optional but very useful because it provides a possible interface between the user and the system. 50% of the agents represent the agents built for this specific application (Supervisor_Agent, Local_Agent1, and Local_Agent2).

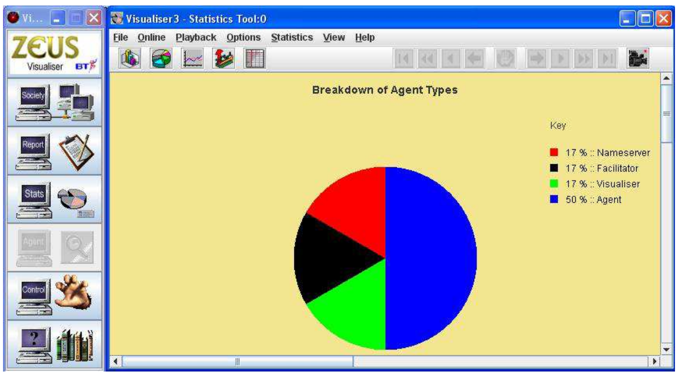

Figure 6. The Statistics Tool of EvalMAS System in Zeus with the breakdown of agent types

Another statistic can be done for the traffic volume distributed by agent, as in figure 7. This statistic shows that the majority messages among agents provide the needed information in order to achieve the overall goal.

Figure 7. The traffic volume- distribution by agent of EvalMAS System in Zeus

5. Conclusions

The development of an online air quality monitoring knowledge system can be done by using intelligent agents. The paper presented a first version of a multi-agent system, EvalMAS that realizes the employee's periodic knowledge evaluation of the air quality monitoring network in the Ploiesti town.

This version was implemented in Zeus, by using the main facility of this agent development toolkit, fast implementation of a multi-agent system prototype. This experiment concludes that the main advantages of using an intelligent agents-based solution, given by the reactivity and the pro-activity characteristics of the agents, as well as their social facility, the agent inter-communication in a specific agent language (e.g. FIPA ACL) support the idea that a multi agent system provides a good solution for on-line monitoring, analysis, and control of real world systems.

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A software application for modeling the production planning in a flexible manufacturing system

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Abstract

Flexibility in manufacturing refers to the ability to allow variation in assembly part and process sequence, change the production volume or the design of certain product that are being manufactured. So the flexible manufacturing systems are based on asynchronous events parallel in time, that concur to a certain common goal. The modeling of flexible manufacturing systems has the main objective of testing the general and specific properties of the proposed model. The confirmation of the specific properties means that the structure of the adopted model is correct and that there are no modeling errors. In this paper is presented a software application for modeling the production planning in a flexible manufacturing system using Petri Nets.

Keywords: Production planning, Flexible manufacturing systems, Petri Nets

1. Introduction

The Flexible Manufacturing Systems (FMS) are represented by a complex discrete event dynamic system. In this context the optimal utilization of the available resources is extremely important in order to improve the productivity (Silva Ribeiro et al, 2008). Flexibility in manufacturing refers to the ability to allow variation in assembly parts and process sequences, to change the production volume or the design of certain products that are being manufactured. So if the number of resources or the number of the jobs increases, the complexity of production planning and scheduling increases too (Jyothi, 2012).

In this paper is presented a software application that can be used for modeling the production planning in a considered flexible manufacturing system using Petri Nets.

The main objective of modeling the flexible manufacturing system before implementing it are related to the test of the specific and general problem attached to the proposed model.

If the behave of the proposed model is the expected one and the model has the expected properties, it means that the structure of the system is correct and that there are no modeling errors. In this case the proposed model can proceed to the next phase of the implementation.

2. Production Planning in Flexible Manufacturing Systems

The production planning in Flexible Manufacturing Systems refers to the determination of the specific sequence in which the jobs are to be processed in different production stages and the determination of the start and the completion time of production jobs.

The importance of the production planning optimization is related to the optimization of the resource utilization and the minimization of the makespan (the time difference between the start and finish of a sequence of jobs or tasks).

An effective plan manages to realize an efficient utilization of the resources and helps to achieve the planned strategic objectives (Jyothi, 2012).

In the production field there are a various types of problems regarding production planning such as single machine scheduling, parallel machine scheduling, flow shop scheduling and job shop scheduling problems and each of these type of problems are unique considering the objectives and constraints.

A Flexible Manufacturing System if formed of (Silva and Valette, 1990):

- A set of flexible machines;
- An automatic transport system;
- A decision making system.

The flexible machines have the capability of performing different operations and are equipped with an automate storage/retrieval system and predetermined programs for each operation.

The automatic system is required in order to transport the parts to the machine where the next operation is located.

The decision making system is the most important part of the FMS because it organize the production and schedules and synchronize the machine utilization in order to function together in harmony.

In this paper the proposed problem refers to a flexible manufacturing system composed of six machines where three types of products can be obtained, as presented in Table 1. The technological machine succession for each product is different and represents the problem's constraints. Storages are attached to each machine with a limited of storage spaces. At each moment of time a single product can be processed on a specific machine.

Table 1. Technological Machine Succession

Product Type	**Technological Machine Succession**
Product 1	M1-M3-M6
Product 2	M2-M3-M6
Product 3	M4-M5-M6

The simulation of production plan contains the tasks sequence, the accessing machine order including the starting time on each machine and the completion time of each task taking into account the specific technological machine succession of jobs and will offer information regarding the coherence of the proposed model.

3. Modeling FMS using Petri Nets

A Petri Net represents a 5-tuple, PN=(P, T, F, W, M_0) where (Murata, 1989):

- P={p_1, p_2, …, p_n} represents a finite set of places;
- T={p_1, p_2, …, p_n} represents a finite set of transitions;
- $F \subseteq (P \text{ x } T) \cap (T \text{ x } P)$ represents a set of arcs;
- $W : F \rightarrow \{1, 2, 3, ...\}$ represents the weight function;
- $M0 : P \rightarrow \{0, 1, 2, 3, ...\}$ represents the initial marking.

The behavior of many systems can be defined taking into account the system states and the changes that occur into this states (Murata, 1989).The transition rule that manages the way that marking state changes in a Petri Net, with the purpose of simulate the dynamic behavior of the proposed system, is (Murata, 1989):

- A transition t is considered to be enabled if each input place p of t is marked with at last *w(p,t)* tokens, where *w(p,t)* represents the weight of the arc from p to t;
- An enabled transition is fire when the event actually takes place;
- Firing of an enabled transition *t* removes *w(p,t)* tokens from each input place *p* of *t* and adds *w(t,p)* tokens to each output place *p* of *t*.

In the last two decades Petri Nets were used in various application fields to model, simulate and analyze the discrete events systems: flexible manufacturing systems, expert system verification, communication protocol for digital telephone network, electronic control of money transfer (Yeung et al, 1996).

Silva and Valeete proposed a way of using Petri Nets for modeling Flexible Manufacturing (Silva and Valeete, 1990). In 1993 Scarpelli and Gomie proposed the utilization of Petri Nets for modeling the Manufacturing Systems (Scarpelli and Gomide, 1993). In 1994 Hanna, Buck and Smith developed a model for a FMS cell using Fuzzy Petri Nets in order to control vision system and robot behavior (Hanna et al, 1994).

In this paper, in order to model the proposed system, the corresponding Petri Net is build using the *Visual Net Object ++ Evaluation Version 2a* software.

The transitions of the Petri Net are represented by the activities or the changes of states of the system elements. The places of the Petri Net are represented by the areas of the system were queues forms or states of the system elements.

Number of tokens in a place that represents a queue corresponds to the number of pieces in the corresponding area of the system.

The presence or the absence of a token in a place corresponds to the existence values of the corresponding state. For example the transition t_{11} represent the activity of arriving of the lots f pieces of type A. The arcs p_1-t_{11} and t_{11}-p_{11} represents the loading of the machine m_1 with raw material from the first deposit.

Table 2. Proposed system characteristic

Name	Capacity	Queue Type
M1, M2, M3, M4, M5, M6	1	FIFO
p11, p12, p13, p14, p15, p16, p17, p18, p19, p21, p22, p22r, p23, p24, p25, p26, p27, p28, p31a, p31b, p32a, p32b, p33, p34	1	Random
p10, p20, p15r, p24r	4	Random

The purpose of this application is to create a model of the proposed flexible manufacturing system and to simulate his activity for a period of time. This model is presented in figure 1. After analyzing the system activity and the results, different changes can be made in order to obtain the structure of the system suitable for the specific requirements.

After running a series of tests a series of changes were made considering the characteristics of the model. For example the dimension of the storages was modified to 3 so it can provide an efficient flow of the jobs, as presented in table 3. The goal is to determine the specific properties and structure that will increase the system productivity and efficiency.

*Table 3.*Final results

Name	Capacity	Queue Type
M1, M2, M3, M4, M5, M6	1	FIFO
p31a, p31b, p32a, p32b, p33, p34	3	FIFO
p11, p12, p13, p14, p15, p16, p17, p18, p19, p21, p22, p22r, p23, p24, p25, p26, p27, p28	2	FIFO
p10, p20	5	FIFO
p15r, p24r	3	FIFO

4. Conclusions

Nowadays there are a huge number of researches in the flexible manufacturing system area that share a common goal: to find solution to increase the productivity and to achieve a more efficient manufacturing system.

Petri nets can be successfully used to analyze and model the flexible manufacturing systems and to evaluate the production rates with different production settings.

In this paper is presented a software application with the main objective of testing the general and specific properties of the proposed model. After changing the model properties and structure considering the results, the confirmation of the specific properties means that the structure of the new adopted model is correct and that there are no modeling errors.

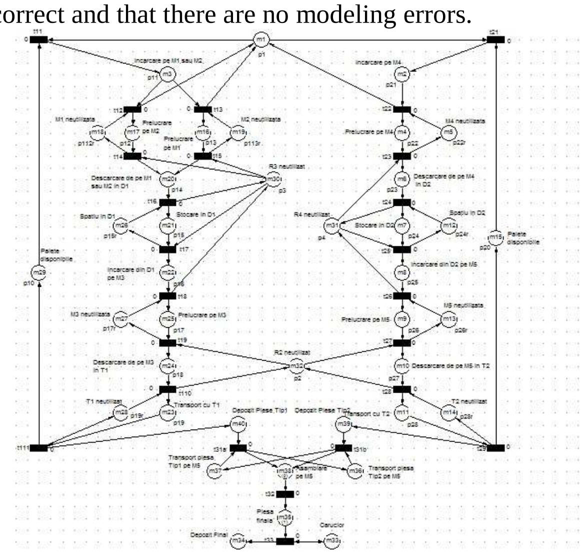

Figure 1. Model of the proposed FMS

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Interactive Digital Textbooks for Math Learning

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Abstract

Major structural changes in our modern society require a new national curriculum, based on generic skills necessary in the 21st century. As basic knowledge in Mathematics and Science is one of the most important components, it puts the question of developing some digital textbooks for learning Mathematics. What features should be met, what changes would occur in the work of a teacher, which models should be chosen in order to make Mathematics more accessible to all students - are the questions we try to answer in this paper. We would like to illustrate this by presenting an educational software for a Geometry lesson, "Discovering and Proving Circle Properties", for the seventh grade, developed by the author after completing the Professional Development Program "The teacher – Creator of Educational Software", project financed by European Funds, Sectorial Operational Program Human Resources Development 2007-2013.

Keywords: digital textbook, math learning, guided learning, practice book

1. Interactive Digital Textbooks for Math Learning – Need and Opportunity

Technological developments in pace exponentially along with the massive traffic of information, which minimises distances, physical or cultural, in a way unimaginable until recently, resulting in the globalisation of the society and changing the way of thinking and understanding the world of new generations. Under such circumstances, remodelling the educational paradigm becomes a necessity. Along with the classic (printed) textbooks and the traditional approaches to the educational process, new methods, based on recently developed technologies, are gaining ground.

The European educational policy reveals the need for rethinking the school curricula, based on generic competencies identified as being necessary in the 21st century, and the textbook is still considered the main instrument for the implementation of the curriculum through its attributed functions: „the transmission of knowledge, development of skills and competencies, consolidation of acquisitions (knowledge, abilities, skills), organisation and management of the process of learning, evaluating students' acquisitions, support for integrating acquisitions, social and cultural education." ([1]). Thanks to new technologies, there arises the opportunity of developing and using digital textbooks, able to offer a richer learning experience compared with traditional textbooks, which might lead to better results.

Pedagogues, psychologists and experts in educational design, teachers and professors, experts in e-learning and IT do studies that reveal how new technological environments for learning, from computers to tablets or smart-phones, can provide more efficient and interactive ways of learning, thus getting students to solve problems closer to the ones which might occur in real life. We have recently come to definitions of digital textbooks ([2]), as well as, prototypes of digital books, at present tested in our schools ([3]). On the other hand, the limits and the risks of inadequate digitisation of the learning content should not be ignored. ([4])

Beyond the general principles that underlie the development of digital textbooks, we have in mind the specificity of the chosen school discipline – it is not in the same way that we teach Mathematics or Literature – and the level of the study – the characteristics of students' development level entail different approaches at the level of primary education, lower secondary, respectively upper secondary.

„ Under the conditions in which information sources get multiplied, and the access to knowledge is now open to more and more people, the textbook (either digitised or classic support) must place emphasis on the use of knowledge, on building the approach towards investigating a specific domain and the ability to transfer knowledge and techniques of intellectual work from one area of knowledge to another. The focus on the student's work becomes more and more important." ([1]) In the case of Mathematics, digitisation supports these desiderata. By exploiting the facilities of new technologies, it is possible to create an optimal environment for using the method of solving problems, learning through practice and self-assessment. Thus, this digital textbook will acquire the role of a Practice Book, a „magic" one, which shall notify the student if the solution is correct, giving him an immediate feedback, which is a factor with important role in motivating and improving learning.

2. A Digital Mathematics Lesson – Lower Secondary Level

National and international assessments show that the overall level of the students' preparedness in Mathematics and Science is not satisfactory. The advanced countries, in terms of technology, pay a lot of attention to the training of skills in Mathematics and Science – in USA, *the Math Now Program* aims at advanced Math programs for primary and secondary school, Japan develops "top science schools" for Mathematics, Science and Technology, through an innovative curriculum, for future scientists to ensure progress, Korea sets up classes for advanced studies that are offered only to those who have passed the compulsory topics, in Taiwan, there are classes for brilliant students in Mathematics and Science ([1]). Moreover, the educational policy of these countries emphasises the central idea to encourage students not only to assimilate scientific information, but also, to develop capacity to look at the world and to make it interact in a scientific way.

US K12 standards, set out through *Science For All Americans*, suggest that educational activities should focus on connections between Science and other disciplines, connections that occur naturally in the physical and biological world studied by scientists, but which are rarely shown in the traditional curriculum. In Romania, the first steps are taken in this direction only now by proposing the development of new curricula, including at the level of each school subject at least one trans-disciplinary or cross-disciplinary module.

The Maths lesson we want to present in this paper is addressed to the students from the VIIth or VIIIth grades, having as topic the main notions related to the *Geometry of the Circle*, the discovery and justification of geometric properties in a circle and how we can apply them in an interdisciplinary context. The lesson also contains a module dedicated to practice and assessment, decisive stage for building good competencies in Mathematics for all students.

2.1 Dynamic and interactive presentation of the notions

Taking into account the age of the target group, we stake on the ludicrous aspect of the lesson, with a role in motivating the students. Thus, this lesson will be accompanied by a character named *Squary*, coming from a strange world, in which the *Circle* is completely unknown. The student will have the opportunity to interact with the learning material. The images are dynamic, changing their appearance through interaction, revealing, one by one, the components of the geometric figures.

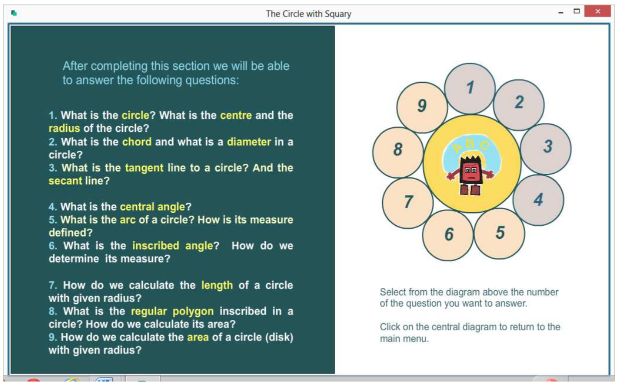

Figure 2. The menu of the first part of the lesson

In the first part of the lesson, the student knows the basic concepts related to the geometry of the circle. The access to the nine components is non-linear, through the menu shown in **Figure 1**. The disks corresponding to the completed components have a different colour from those which have not been completely done yet.

The process of understanding the geometric notions is facilitated through the use of dynamic images: unlike the printed textbook, the digital textbook allows the presentation of the circle as the trajectory of a moving point, which is situated at a constant distance – the radius of the circle – from another fix point, called the centre of the circle.

The nine moments of the lesson, accessed via the menu shown in Figure 1, contain both definitions of geometric concepts, together with interactive images, which will highlight the key components and will provide the intuitive support, and exercises with immediate feedback, aiming to fix and verify the acquired notions, as well as the ability to use them.

For example, the image shown in **Figure 2** presents the definition of the arc of a circle. The small arc *AB* had changed its colour to red, after the user tapped one of its points; there was also displayed its name and the appropriate notation. When you have reached a certain point on the major arc *AB*, the latter will become red and will display its name, while the little arc will return to its original colour.

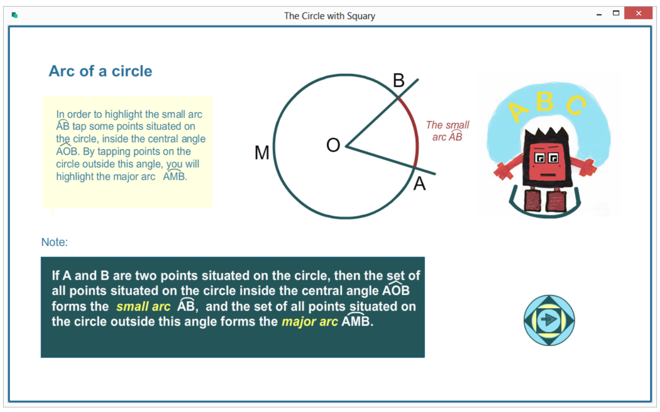

*Figure 3.*The components change their colour when tapped

After defining the arcs of the circle, there are presented the relations between the measure of the central angle and the measure of the arcs and some exercises are proposed in order to apply the formulas. The student will fill in the boxes with the calculated values, and the application will provide a feedback through the character *Squary* that jumps gleefully at every good answer; when the correct answer is introduced, the button for moving on to the next frame of the lesson will be activated.

In order to give the formula for calculating the length of the circle, an interactive simulation is used (**Figure 3**): a wire that surrounds the circle unrolls until it takes the form of a straight segment; with the help of the ruler, the students will measure the length of the wire, then they will be able to introduce the number, expressed in millimetres, in the appropriate box; in the same way, the students will measure the diameter of the circle, then will calculate the ratio of the two lengths and fill in the numbers. The application checks the introduced data, provides feedback and advances gradually as the tasks are performed correctly. The diameter which will be measured is constructed by simply tapping the centre of the circle. In the end, after finding out and stating the relationship between the length and the radius of a circle, an exercise is proposed.

2.2 The discovery and justification of the properties – from intuition to scientific rigour

Learning Mathematics in school is not limited to the formulation of rules or the application of algorithms. By learning Mathematics, we learn to do more complex reasoning; the role of Mathematics is recognised in training the qualities necessary for abstract, coherent and critical, properly articulated thinking. Thus, our teaching approach will rise from the intuitive level, based on observations, to the level of scientific reasoning and rigour.

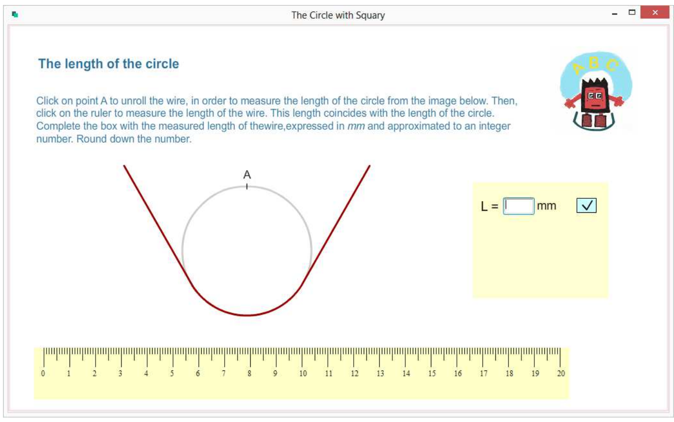

Figure 4. Interactive simulation – we measure and calculate the value of PI

We will illustrate this statement by presenting the proof to one of the theorems included in the application (**Figure 4**). The demonstration of the theorem of the angle inscribed in a circle brings the student an interesting example of how solving a particular case of a problem can help to solve the general case.

In the left panel of the application, we can see the demonstration of the theorem when one side of the angle passes through the centre of the circle; by tapping the centre of the circle, the radius *OA* is constructed, then we apply the property related to the exterior angle of a triangle and the theorem is rapidly justified for this particular case. The student will follow the reasoning and will complete the required data in the two boxes.

The central panel presents the demonstration of the theorem when the centre of the circle is situated inside the inscribed angle: by tapping the centre of the circle, we construct the diameter from the vertex of the angle, and the measure of the inscribed angle will be the sum of the two angles formed, which we can calculate like in the previous case.

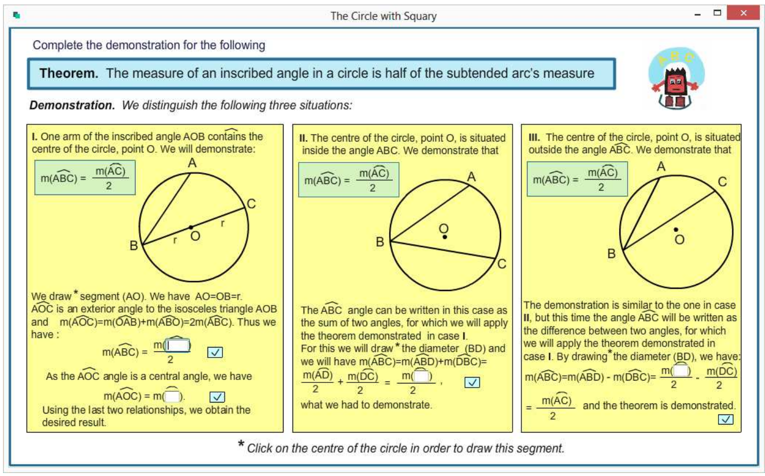

Figure 5. The demonstration of a theorem – auxiliary constructions and subtle reasoning

Similarly, the right panel shows the demonstration of the theorem when the centre of the circle is located outside the angle: through a similar auxiliary construction, the angle is written as the difference between two angles similar to those in the left panel.

Then, the theorem will be applied for the angle inscribed in a semicircle. There is included another dynamic, interactive image: the students have the possibility to move the vertex of the angle anywhere on the semicircle, viewing that the measure of the angle remains constant and the arms of the angle are always perpendicular.

All these dynamic images, together with the tasks that students have to solve, will help them to be more involved, thus building a correct representation of the notions and relationships in geometry. Compared to static images in the printed textbook, the digital lesson makes the understanding of the notions more accessible to more students. The immediate feedback, given after solving each requirement, plays an important role in improving the learning process.

2.3 Interdisciplinarity and transfer of knowledge

The second main section of the lesson proposes nine problems to be solved, with practical and interdisciplinary nature. The access to these problems can be non-linear, from the second menu of the application. As an example, which we show in **Figure 5**, the way in which the student is led in the solving of the problem of the determination of the diameter of a ball's shadow, if the distance from the light source to the wall and the distance from the ball to the light source are known. The reasoning is built step by step, the student will fill in successively the requested numbers by applying the theorems learned – the Pythagorean theorem and the similarity of triangles –, finally getting the desired result.

The six boxes that are to be completed for solving the problem show the path to be followed by the students to construct their reasoning. In order to complete the first box, the students must realize that the segment is actually the radius of the circle, whose diameter is given. We must note that although this requirement is trivial, a significant number of students may have difficulties in solving them! It is about the phenomenon of functional illiteracy: although the students can read, memorise and reproduce certain statements, in fact they do not understand and cannot apply what they read – a phenomenon which can be reduced only by solving such exercises every day.

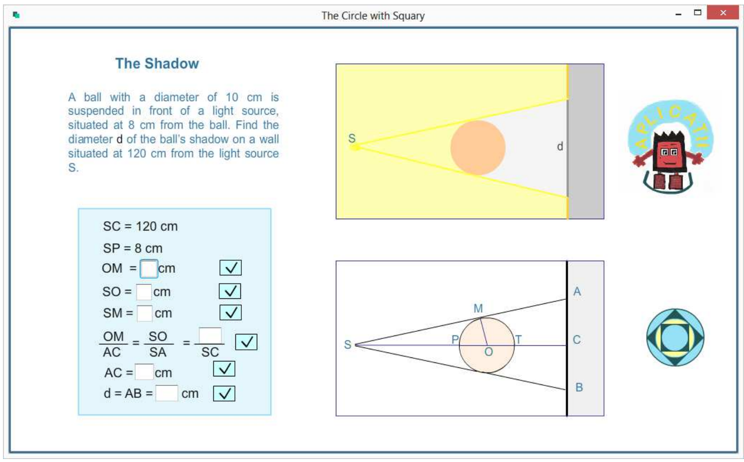

Figure 6. Solving a practical problem – guided learning

The degree of difficulty in completing the 6 boxes increases gradually: for the second box the students must realize that the length can be calculated as the sum of the distances from the light source to the ball and the radius of the ball; for the third box the students have to apply the Pythagorean theorem in a right triangle, for the fourth box they will complete the relationship of proportionality of similar triangles' sides, thus being able to complete the last but one box. The final answer to the problem will be introduced in the last box, using the same relationship between the radius and the diameter of a circle. The feedback is provided after completing each box, when the user clicks on the Enter or Verify button.

2.4 The role of practice in achieving mathematical competencies

Basic skills in Mathematics and Science are among the key competencies identified as necessary for our graduates of the compulsory education. However, the results of the national assessment and baccalaureate exams show that a large percentage of our graduates were unable to meet the minimal requirements. The situation could be improved if every student had the possibility to practise independently, in their own pace, solving the types of questions proposed to these exams. Experience shows that the vast majority of students can improve their performance in Mathematics through practice, if they notice that their results are improving. The digital textbook will be able to provide the assisting function in the process of learning, with the possibility to practise until the students are able to use the notions and work techniques correctly.

For the lesson *Circle and its properties* we created a set of nine items with auto generating data. We want to exemplify this with the following item, with over a quarter of a million variants (namely 257 544 variants), which randomly auto generates at each run of the test. Here is a variant of the item: the points $A_1, A_2, \ldots, A_{72}$ divide a circle into 72 equal parts. Find the measure of the angle $A_5A_{15}A_{40}$. The variant was generated using the following pattern: The points $A_1, A_2, \ldots, A_n$ divide a circle into n equal parts. Find the measure of the angle $A_iA_jA_l$. The generator randomly picks a divisor k of 60, then considers n=6k and chooses for i a random value between 1 and k, for j a random value between k+1 and 3k, and for l a random value between 3k+1 and 6k. For each set, the application calculates the correct answer, in order to provide feedback to the student. The student will enter the answer, then will operate the verification button. If you have entered the correct answer, you can move on to the next item, otherwise you can try again. The application also contains a button which allows the display of hints for each problem.

3. Conclusions

The main priorities of the current teaching methodology are the need for personalised learning approach and the emphasis on learning through cooperation. *Personalised sapproach in learning Mathematics* at lower secondary school level can be accomplished either through a significant reduction in the number of students in a class (10-12) or through the development of digital textbooks, able to assist the students in the learning process. At lower secondary level, the students are only at the stage of mathematical initiation, skills are formed by working individually, at their own pace, until the proper knowledge and techniques are gained. If the current and the final evaluations will be conducted in accordance with the items included in the digital textbooks, the students will have all the necessary motivation to practise, having the above described self-assessment tool.

It is necessary for the teacher to perfectly know all the learning contents in order to support the students with appropriate explanations. The teacher's encouragement, along with improved scores at each run of the tests, will win the students for more practice with greater confidence in this exciting game of mind: Mathematics – a game through which we form higher cognitive skills, analytical and conceptual thinking, skills related to personal effectiveness, self-control, self-confidence, flexibility, competencies oriented towards development and action, concern for order, searching for information and development of intuition – competencies that are needed in today's world, which calls for a continuous adaptation through innovation.

On the other hand, the *cooperative learning of Mathematics*, in the case of lower secondary level, begins with the knowledge and practice of the rules of the dialogue: the students will learn to listen carefully to their classmates' views and reasoning and to clearly express their own point of view. Consequently, working with chalk and blackboard in Mathematics is not and will not be outdated soon. For the success of such an approach, we need teachers to transpose mathematical knowledge to a language accessible to the students, with flexibility in approaches and observing the principle of intrinsic mathematical rigour.

The transition from stating these principles to their application in school, day after day, requires the involvement and cooperation of all actors of the educational system, starting with the decision makers, which should act fairly to make a real change – not just in words.

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Educational software: Linguistic Training method for foreign languages' speakers

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Abstract

This article describes the educational applications of own conception ("DicEl" and "RecitalMaster") developed by the author for studying the Romanian Language by language regions' people via of other close themed projects. Proposed educational software are applicable in the conditions of: self-study; student-teacher contact (full and-or partial, or at the distance). These elaborations are absolutely adaptable for studying other foreign languages.

Keywords: Educational Software, Digital Skills, Linguistic Training.

1 Introduction

Today knowledge and using of computer products and information, including communication technologies (ICTs) are becoming a mandatory goal of contemporary man. Society’s requirements call for a permanent optimization of teaching and learning, in general, and of language’s studying especially, the most important link in this context for multilingual citizens of Republic of Moldova is learning of Romanian language, as a mother language and also as a language of interethnic communication. The intersection of these two aspects of social and educational defines conditions’ creations which ensure high efficiency in the studying process of Romanian language through implementation of educational software able to respond to demands of society and pupils' personality of gymnasium level (Burlacu Natalia, 2010).

The interest in studying the issue of languages by the aid of computer is determined of the need for centring educational process on the pupil, as he became subject of educational process in this question, which requires a individualization of that (educational process). Computer's using is an optimal opportunity to individualize the educational process.

In the context of formative-productive education we should be concerned not only in studying of Romanian language through traditional methods and strategies, student's attitudes towards immanent language's values, but also in skills' extension of information and communication. Thus, there is need to use the computer as a tool in Romanian language's learning, considering that just this type of studying is of great value in functional terms.

1.1 Concept of educational applications "DicEl" and "RecitalMaster"

Intended to meet the requirements set out in the Delphi programming environment have been developed two educational applications of own conception: "DicEl" and "RecitalMaster". These educational software serve to build and preparing written and oral language skills to individuals of different ages Romanian, Romanian native carriers or speakers of other languages than Romanian, which in the conditions of Republic of Moldova and Romania, feel the need to increment the competencies grammar, spelling and orthoepic in different compartments of the Romanian language for the multiplication of theirs academic success, social integration and/or augmentation of fruitful impacts of professional life.

Through these educational products the knowledge of spelling, punctuation, development of phonemic hearing - Romanian language specific may be granted in an auditorium's conjuncture in the during of contact hours with the teacher or in during of self-regulated learning. Romanian language's adequate competences have an important and quite high percentage in the various levels of studies, especially at: primary, secondary, higher and continuing education, with serious impacts on the entire itinerary of life, particularly at career.

For creating an effective dialogue with prospective user in both proposed applications - "DicEl" and "RecitalMaster", into the best traditions of software development, have been developed interfaces with unified aspect, provided with common menu bar (see *Figures 1, 2*) in the style the Windows' applications, which aim to facilitate the interaction of potential applicants to use the gave product with internal system of described applications, source flies' organization, error correction mechanism, printing process and electronic reproduction of learning's activities results. Order to reflect applications' interferences "DicEl" and "RecitalMaster" have been elaborated *Table 1*.

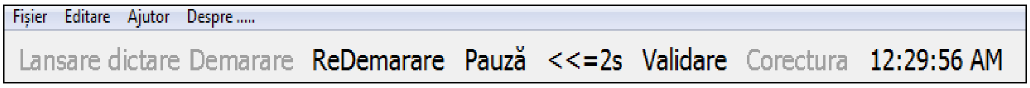


Figure 1. The menu bar of application "DicEl"

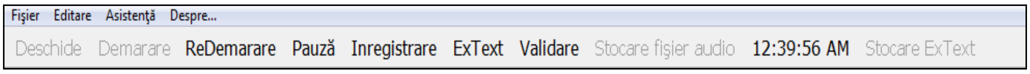


Figure 2. The menu bar of application „RecitalMaster"

The model of developed educational software, as the whole research, promotes the idea to approach through competencies the training process.

2 Educational software's implementation of Linguistic Training for languages' speakers

For determining the efficiency degree of proposed applications in the course of the Romanian language's study by Romanian non-speaking people, in the period from 1/02-25/05 - 2013a.st. into theoretical lyceum (LT, High School) "OLIMP" from Chisinau has been initiated a pedagogical experiment with implementation of software applications "DicEl" and "RecitalMaster". During the experiment, we had monitored the independent variables' effects: ways to promote organization forms in the sense of training and development of the Romanian language's written and oral skills to the people participated in the experiment; providing to pupils didactic materials into electronic format - supplying the above-mentioned applications; source files in formats of: *. mp3, *. doc, *. wav - previously encrypted in order to protect the data and to prohibit unauthorized accesses in educational contents, which can be sometimes of the current or final evaluation of knowledge; delivery of support information relating to cases of software's applicability, etc., the dependent variables: training and development digital skills' level and current linguistic preparation level in Romanian language of the students. Additionally, we compared the level of motivation of participants in the experiment, an item which was designated as intermediate variable.

Table 1. The menu bar's components of applications: "DicEl" and "RecitalMaster"

Nr:	Menu	Presence / absence of the function and menu's purpose in application	
		DicEl	*RecitalMaster*
1.	**Dictation's Release / Open the Exercise**	The sole active menu on the entry into working interface of the application; displays tree structure of the location on the hard disk from where can be opened the selected dictations. All dictations placed in the working location of application have to be processed in a special and originally way presented in two basic formats: of audio file *.WAV or *.MP3 and some standard: of *.DOC - its then are subject to serious decrypting modifications provided by given application.	The sole active menu on the entry into working interface of the application; displays tree structure of the location on the hard disk from where can be opened for expressive reading exercise. All texts placed in the working location of application have to be processed in a special and original way presented in two basic formats: of audio file *.WAV or *.MP3 with or without auxiliary file *.DOC, which contains forward the literary text and / or sequence of text (in prose or lyrics) for study.
2.	**Start**	Accessing the given menu it start playing the audio content of chosen dictation; into the file, according to the method of dictation's implementation is recorded the first reading of the text - integrally; the second reading - dictation of text's phrases; followed by reading three - dictation of text's syntagms; the fourth reading, dictation of phrases again; the final reading - verification of dictated text.	Accessing the given menu it starts playing the audio content of chosen marked sound sequence.
3.	**ReStart**	Stops scrolling of current electronic audio dictation; audio file recovery can be performed only acting on again the Start menu.	Stops scrolling of audio track dedicated to the expressive reading text; relaunch audio file can be achieved only acting on Start menu again.
4.	**Pause**	Stops scrolling of current electronic audio dictation; repeated Pause Menu's operation resumes scrolling of the audio file from where it has been stopped.	Stops the audio scrolling of current recording; repeated Pause Menu's operation resumes scrolling of the audio file from where it has been stopped.
5.	**<<=2s**	Scrolls of dictation, repeating the now read text two seconds ago; can be operated several times, repeating of dictation will be done from position of: Nr_of_clicks * 2 seconds ago.	-
6.	**Check**	Makes the verification of written, given the algorithm implemented in the application, which compares the student's written version with the original dictation.	-
7.	**Correction**	Opens the work area's second part of application, displaying all written by the student with all errors' marking committed by him.	-
8.	**Statistics**	Displays a box, presenting statistical data regarding the number of errors committed by the user - at the level of characters and words against the total number of text's characters and words.	-

9.	**Registration**	-	Make available to users the opportunity to make records of expressive reading in many audio file formats such as uncompressed WAV (PCM), Compressed WAV (ADPCM, A-LAW, U-LAW, DSP, GSM, etc., MP3 (MPEG Layer-3) ratio of 8, 16 or 32 B, which allows correctly recording and reproduction of text that has been pronounced previously at the moment of sound's creation record.
10.	**Validate**	-	Performs the storage of sound sequence with expressive reading recently recorded at the level of algorithm implemented in the given software.
11.	**Save Results of Dictation Save Audio File**	Saves the dictation's results in one of working locations of application; saving is made in a *.DOC file, formatted: name and surname of student; system date and time, including its seconds; dictation's text written by the student; total number of text's characters; total number of modified, further, omitted character and the total number of words, all of its followed by original text of the dictation.	Achieved expressive reading record results can be stored in file formats *.WAV or *.MP3 on the host computer, local network server or any computer on the network off-line, sent on-line to in a distant place computer.
12.	**Close**	Enables the dictation closure and exit from the application; accessing given menu program will display a dialog box that will ask for salvation's confirmation of dictation made with or without leaving the application.	Enables leaving the personal development's regime of audio file with artistic content and possible abandonment of the application by clicking *Exit* on the program's *File* menu. There is will display a dialog box which ask for confirmation rescue sequence perform with or without leaving the application here.

The objectives of experiment:

- Demonstrating the effectiveness of developed educational software – "DicEl" and "RecitalMaster".
- Developing of generic digital skills: knowledge of the keyboard; adequate typing of text, taking into account diacritical graphic signs, etc.
- Formation and development of correct writing ability in terms of spelling and punctuation.
- Forming and skill development adequate and expressive artistic reproduction of various literary genres such as epic and lyrical.
- Training and developing the digital abilities to interact with educational applications' modules "DicEl" and "RecitalMaster".
- Setting the level of training and development of specific competence for development and implementation spontaneous, fluent, precise, various acts of oral and written communication into Romanian language to students participating in the experiment.

The experiment included 77 students from grades: VI VIII (native language and study's language of representatives is the Russian language) from theoretical lyceum (LT, High School) "OLIMP", Chisinau, Republic of Moldova. Samples' composition and amount of students from each class is shown in the *Table 2.*

Table 2. Composition of experimental samples from Alolingual School (LT "Olimp", Chisinau, Republic of Moldova)

The experimental group (EE)		*The group of control (EC)*	
Institution / Class	Number of students	Institution / Class	Number of students
cl. 6-th A	20	cl. 6-th B	18
cl. 8-th A	20	cl. 8-th B	19

3. Processing the results of the experiment

There are several methods to estimate the differences / similarities between two samples in statistics. By (Clocotici and Stan, 2001) "The sample is a subset of the statistical population considered".

We call an experimental sample (EE) the sample which was trained by applying the implementation's methodology of educational software developed - "DicEl" and "RecitalMaster" - and a control sample (EC), the sample was trained traditionally.

Resulting from the fact that the amount of in the EC population is not identical to the whole population in the EE, for validation of experimental results have been used two statistical criteria, namely:

1. Criteria Cramer-Welch (Labăr 2008).
2. Mann-Whitney U test Criteria (Opariuc-Dan, 2011).

Homogeneity of EE and EC samples has been determined from the controlled experiment through the use statistical criteria listed above in the given article (see *Tables 3, 4*).

Table 3. Statistical data of training experiment in Alolingual School

The experimental group (x)			*The group of control (y)*	
EE6A			**EC6B**	
Number of students	N (x)	20	N (y)	18
Average mark	M (x)	6.35	M (y)	6.444…
Dispersion (D)	D (x)	2,481578947…	D (y)	2,745894118…
T	**0,1711173137662988697969**…			
Minimum value (Min)	Min (x)	4	Min (y)	4
Maximum value (Max)	Max (x)	9	Max (y)	9
SUM (S)	S (x)	127	S (y)	116
EE8A			**EC8B**	
Number of students	N (x)	20	N (y)	19
Average mark	M (x)	6.4	M (y)	6.5
Dispersion (D)	D (x)	2,025263158…	D (y)	2,4861…
T	**0,20756430…**			
Minimum value (Min)	Min (x)	4	Min (y)	4
Maximum value (Max)	Max (x)	9	Max (y)	9
SUM (S)	S (x)	128	S (y)	124

Cramer-Welch criteria applied on collected statistical data show that between the experimental samples EE6A and EC6B; EE8A and EC8B no significant differences.

Based on the data presented in Table 4 and EC6B EE6A experimental samples; EE8A and EC8B at **STAGE CONTROL EXPERIMENT** showed significant differences, while at the **EXPERIMENTAL STAGE TRAINING** already show significant differences in levels of student preparation of the samples subjected experiment (see *Tables 4, 5*).

Table 4. Mann-Whitney U criteria applied to determine the homogeneity of the samples.
EE and EC's Sum of Ranks calculation.

Phase of control experiment 1-2						
The experimental group (x)				*The group of control (y)*		
EE6A				**EC6B**		
Sum of Ranks	T1 (x)		323	T2 (y)		302
Total Sum						742
Sample Volume	N1(x)		20	N2(y)		18
	W1 (x)		227	W2 (y)		211
	U					211

EE8A				**EC8B**		
Sum of Ranks	T1 (x)		331	T2 (y)		321
Total Sum						652
Sample Volume	N1(x)		20	N2(y)		19
	W1 (x)		239	W2 (y)		230
	U					230
Phase of training experiment 1-2						
EE6A			**EC6B**			
Sum of Ranks	T1 (x)		454	T2 (y)		276
Total Sum						730
Sample Volume	N1(x)		20	N2(y)		18
	W1 (x)		96	W2 (y)		237
	U					96
EE8A				**EC8B**		
Sum of Ranks	T1 (x)		452	T2 (y)		312
Total Sum						764
Sample Volume	N1(x)		20	N2(y)		19
	W1 (x)		118	W2 (y)		239
	U					118

Table 5. Empirical calculated values by statistical criteria

Value of U_{emp}	**Critical Value of U_{cr} 0,05**	**Samples**
Phase of control experiment		
211	112	EE6
230	119	EE8
Phase of training experiment		
96	112	EE6
118	119	EE8

Since the U_{cr} <U_{emp} (see experimental phase control - Table 5), both statistical criteria indicate significant differences between levels of student preparation of the samples subjected to the experiment.

Since U_{cr}> U_{emp} (see experimental stage training - Table 5), both statistical criteria indicate significant differences between levels of student preparation of the samples subjected to the experiment.

Broadly academic achievement representatives EE6A lots, EE6B, EE8A, registered the following dynamic EE8B expressed in the marks (see *Table 6, Figures 3-6*).

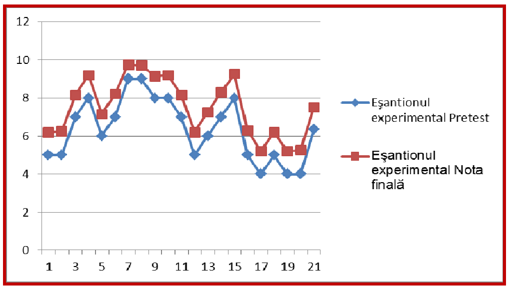
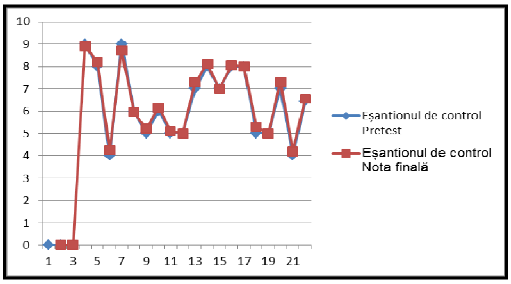
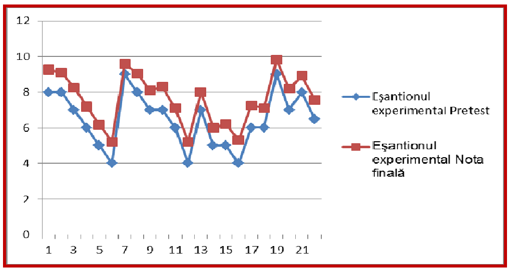
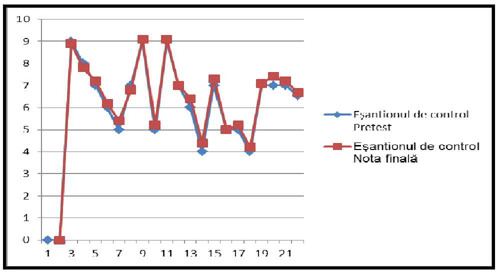
4. Conclusions

The resulting values of EE are higher than the results of EC, which confirms our intention to optimize the acquisition and development of skills to non-native students to write correctly and perform expression readings through using the developed by us own design software - "DicEl" and "RecitalMaster".

The success can be recorded as an effective method of language training for foreigners, applicable both under student-teacher fully or partially auditors' contact or remote, or in a self-regulated learning format, concomitant giving pronounced digital skills of the students.

In technological point of view the educational software "DicEl" and "RecitalMaster" are absolutely adaptable and can be perfectly adjusted for other cases the study of modern languages.

Table 6. The groups' dynamics of alolingual students' academic progress at experiment stages: Control and Training

<table>
<tr><th>Control experiment</th><th>Training experiment</th></tr>
<tr><td colspan="2">Class VI, LT (High School) “OLIMP”, from Chisinau</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Figure 3. Experimental group – EE6A</td><td>Figure 4. Group of control – EE6B</td></tr>
<tr><td colspan="2">Class VIII, LT (High School) “OLIMP”, from Chisinau</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Figure 5. Experimental group – EE8A</td><td>Figure 6. Group of control – EE8B</td></tr>
</table>

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Design and Implementation of a Decision Support System for University Course Scheduling using Integer Linear Programming

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Abstract

Constructing a course timetable for an educational institution is a very demanding and difficult job because of considering lots of constraints such as fulfil teaching preferences, conflict in teaching hours and the continuity of teaching hours, etc. A decision support system for university time tabling problem is presented in this paper. Linear integer programming (ILP) is employed in order to build a novel model for university course timetable which could consider the satisfaction of expressed lecturers and students' preferences in terms of teaching periods or days of the week or even classrooms for specified courses. The built model provides constraints for numerous requirements and operational rules which could be detected in most educational institutions. A decision support system (DSS) based on the proposed model is built and the implementation of the DSS have given satisfying results for industrial engineering department of Amirkabir University.

Keywords: Decision support system, Scheduling, Linear programming, Optimization, Timetabling

1. Introduction

Design and implementation of a university course scheduling system conforming to the needs and regulations of universities can fulfill the requirements of many staff and students in a university. In many academic institutes, educational authorities slightly modify their previous year schedule (which has been obtained through trial and error), and apply it as their educational plan for the new semester. Regarding the constant changes imposed every day, application of previous schedules with small changes is not necessarily the best policy. This is while it is available to present an automated system for course scheduling through application of engineering and information technologies (Schaerf, 1999).

The course scheduling problem can be defined as “the process of university course allocation to specific times in a weekly program, considering the appropriate class and facilities required for presentation of the course” (Abbas and Tsang, 2004).

Any educational plan to be applied needs to fulfill the following limitations. These limitations are provided below with their corresponding explanations:

- Interference of professors’ schedules: At a single time period, a professor has more than one course.
- Interference of students’ schedules.
- Interference of class schedules.
- Professors’ presence times.

- Course scheduling must be complete. A course schedule is complete when all the courses required for all the educational programs are presented, and the necessary hours for each course are allocated, and the corresponding professors are determined.
- The required number of sessions per week. In the time table for each course, the number of sessions required in a week must be taken into consideration, and also a sensible interval between the sessions is to be considered.
- Facilities essential for presentation of courses must be provided and the class capacity must be appropriate.
- Available hours of each class are to be taken into account. In the time table, the hours when a class is available must be considered. In some universities, a class is commonly used by several departments.

In addition, the following assumptions exist in course scheduling in university:

- In many universities, courses are divided into the two categories of compulsory and elective courses. The courses which are required to be passed by students as a partial requirement of a specific major or field of study are called compulsory courses. In this study, planning is carried out for the both classes of compulsory and elective courses.

This paper is organized as following. In section 2, the most related works are mentioned. In section 3, a novel model for course scheduling is introduced. The evaluation results are discussed in chapter 4 and at last our study is rounded off with a conclusion in Section 5.

2. Literature Review

Design and implementation of a university course scheduling system conforming to the needs and regulations of universities can fulfill the requirements of many staff and students in a university. In many academic institutes, educational authorities slightly modify their previous year schedule (which has been obtained through trial and error), and apply it as their educational plan for the new semester. Regarding the constant changes imposed every day, application of previous schedules with small changes is not necessarily the best policy. This is while it is available to present an automated system for course scheduling through application of engineering and information technologies (Schaerf, 1999).

Various methods have been employed so far in order to solve the scheduling problem. A summary of these methods is provided below.

2.1 Linear Programming

Mathematical programming is a sort of optimization techniques applied on a function constrained by independent variables. Even though this method is only applicable in small-scale programming problems, there are several approaches of this kind such as Linear and Integer programming or Lagrange method. Today with the advancements in computers and optimization of the solutions proposed for Linear Programming problems, these methods have attracted attentions again. In order to solve the course scheduling problem, numerous Linear Programming models have been proposed, out of which the most well-known and comprehensive is the Integer Linear Programming model of Daskalaki (Daskalaki and Birbas, 2003; Tripathy, 1984).

2.2 Dynamic Programming

Dynamic Programming is an implicit enumeration method which can be considered as a division and solution technique. In order to solve a large-scale problem, it is possible to break it into several independent sub-problems. Because the first sub-problem to be solved is not known, it is possible to solve them all and retain the results. However, this approach is not efficient for a major programming problem (Held and Karp, 1962; Funke et al, 2005).

2.3 Simulated Annealing

Simulated Annealing (SA) method has recently attracted much attention as a method for optimization problems of very large-scales. This method has managed to obtain good results in solution of the Travelling Sales Person problem. Many approaches of SA are presented in the literature of operation research. As an example, a novel algorithm was presented to attain a proper solution in work study problems which included acceptance of cost increasing movements with positive possibilities in order to avoid local minima. Employing SA for solving course scheduling problem is extremely time-consuming (Ceschia et al, 2012).

2.4 Genetic Algorithm

Colorni were the first to establish application of Genetic Algorithm in course scheduling in Italian schools, and reported successful results. Their model consisted of five elements which they were teachers, programming intervals (hours), courses, weakly program and a function for maximization. They employed a matrix which illustrated the weekly schedule. Each row represented a teacher. Each column was an hour and each cell in a matrix represented a course. In their model, row constraints were always fulfilled, but column constraints could lead to impossibility of solution because of interferences or lack of coverage. Therefore, they made use of filter operators to help the performance of the program. They noticed that their approach could fulfill all the strict constraints associated with their programming problem (Colorni et al, 1991).

Paechter proposed another presentation of the scheduling table. In his presentation, chromosome has some commands for construction of a scheduling table instead of direct presentation of the table. They employed a novel technique, in which the chromosome determines which occurrence must be planned earlier and where it must be positioned. In case this incidence cannot be replaced without violation of the strict constraints, the chromosome determines where the occurrence can be placed and where the next place is. Due to the fact that this search does not cover the whole scheduling table, it cannot be guaranteed that the global optimum would be reached (Paechter et al, 1994).

3. Integer Model

The model proposed for the course scheduling problem is different in various universities owing to the specific conditions associated with a university. Here, a model is presented considering the special scheduling conditions attributed to the computer engineering department of Amirkabir University of Technology.

3.1 Model Parameters

In this approach, 5 parameters have been taken as the basic elements, unlike Daskalaki's model which employed 6 parameters. Reduction in the number of parameters caused the model to be smaller in size, and as a result, the computation time and the required memory decreased as well. In the remainder, these parameters are described (Daskalaki et al, 2004).

- Day: Days in a week on which it is possible to plan for courses, which is denoted by $I = \{1,2,\dots,5\}$.
- Time period: Time periods during a day are those periods in which courses are planned. In the industrial engineering department, 90-minute periods are considered between 8 AM and 7 PM. Time periods are denoted by $J = \{1,2,\dots,7\}$.
- Professors: Professors are represented by $L = \{Professor1, Professor2, \dots\}$.

- Courses: The courses being scheduled for students. The courses potent to be presented more than once in a week (such as courses with three credits) are also assumed as a single course. Courses are denoted by $M = \{C1, C2, \dots\}$.
- Classes: The classes available for the weekly table of courses. Classes are noted by $N = \{Class1, Class2, \dots\}$.

The eliminated parameter is "Students", which is no longer necessary due to application of a constraint on co-requisite courses for students.

The auxiliary parameters applied in the constraints are as below:

- a_{ijl}: where $i \in I$, $j \in J$ and $l \in L$. The value of a_{ijl} equals unity provided that the *l*th professor is prepared to present a course on the *i*th day at the *j*th period; otherwise, the value equals zero.
- b_{mp}: where $m \in M$ and $p \in M$. The value of b_{mp} equals unity if the two courses of *m* and *p* are at the same semester; otherwise, it takes zero. In order to determine the values of b_{mp}, the schedule suggested by the educational office of the university is utilized, and provided that two courses in a single semester are presented in this schedule, b_{mp} is considered to be 1.
- c_m: where $m \in M$. The value of c_m is unity if the *m*th course is presented in the semester planed; otherwise, it equals zero.
- d_m: where $m \in M$. The value of d_m is equal to the number of time periods required for the presentation of the *m*th course.
- e_{mn}: where $m \in M$ and $n \in N$. The value of e_{mn} is unity, provided that the *n*th class bears the necessary facilities essential for presentation of the *m*th course; otherwise, it takes zero. The required facilities include video projection, enough space as much as the number of registered students, etc.
- f_{lm}: where $m \in M$ and $l \in L$. f_{lm} is equal to unity when the *l*th professor is willing to present the *m*th course; otherwise, it equals zero (Daskalaki et al, 2004).

3.2 Model Variables

Three types of variables have been employed, all of which of the binary type. The first group of variables is the main variables denoted by $x_{i,j,l,m,n}$, where $\mathrm{i} \in \mathrm{I}$, $\mathrm{j} \in \mathrm{J}$, $\mathrm{l} \in \mathrm{L}$, $\mathrm{m} \in \mathrm{M}$ and $\mathrm{n} \in \mathrm{N}$. $\mathrm{x}_{\mathrm{i,j,l,m,n}}$ takes the value of unity in case the course *m* is presented in the class *n* by the professor *l* on the day *i* at the *j*th time period. In this model, the variables are changed in such a way that the professor *l* has free time at the *j*th time period on the day *i*, and is willing to present the course *m*, and also the class *n* is appropriate for the course *m*. Therefore in this model, the number of main variables is reduced considerably which causes the model to reduce in size and converge to the answer faster and more accurately.

The second variable is an auxiliary variable presented as $\mathrm{Y}_{\mathrm{l,m}}$ where $\mathrm{l} \in \mathrm{L}$ and $\mathrm{m} \in \mathrm{M}$. $\mathrm{Y}_{\mathrm{l,m}}$ equals unity provided that the professor *l* presents the course *m*.

The third variable is also an auxiliary variable considered in this model. It helps control parallelism of the courses. As an example, if a course is presented on Saturdays and Mondays, the two sessions of it are in a determined time period. The previous model was not capable of including parallelism of courses. This variable is denoted by $Z_{j,m}$ where $j \in J$ and $m \in M$. $Z_{j,m}$ is equal to unity provided that the course *m* is presented at the *j*th time period.

3.3 Model Constraints

The constraints of the course scheduling problem are presented as below:

- Interference of the professors' schedules:

$$[1] \quad \forall i \in I,\ \forall j \in J,\ \forall l \in L \sum_{m \in M_l} \sum_{n \in N_m} x_{i,j,l,m,n} \le 1$$

- Interference of the students' schedules

$$\sum_{l \in L_m} \sum_{n \in N} x_{i,j,l,m,n} + \sum_{l \in Lp} \sum_{n \in N} x_{i,j,l,m,n} \le b_{mp} + 2(1-b_{mp}) \quad \forall i \in I,\ \forall j \in J, \forall m \in M, \forall p \in M \quad [2]$$

- Interference of the class schedules

$$[3] \quad \forall i \in I,\ \forall j \in J,\ \forall n \in N \sum_{l \in L} \sum_{m \in M_l} x_{i,j,l,m,n} \le 1$$

- Course scheduling must be complete

$$[4] \quad \forall m \in M \sum_{n \in N_l} \sum_{l \in L_m} \sum_{j \in J} \sum_{i \in I} x_{i,j,l,m,n} = c_m * d_m$$

- The required number of sessions per week

$$[5] \quad \forall m \in M;\ \forall l \in L \sum_{n \in N_l} \sum_{i \in I} \sum_{j \in J} x_{i,j,l,m,n} = d_m * f_{l,m} * y_{l,m}$$

- Each course must be presented by a single professor:

$$[6] \quad \forall m \in M \sum_{l \in L_l} y_{l,m} = 1$$

- The time interval between the sessions of a course:

$$[7] \quad \forall i \in I,\ \forall j \in J,\ \forall m \in M,\ \forall l \in L_m \sum_{n \in N} x_{i,j,l,m,n} + \sum_{n \in N} x_{i,j+1,l,m,n} \le 1$$

- Previously planned courses must be considered:

$$\forall (i,j,l,m,n) \in PRA \quad x_{i,j,l,m,n} = 1 \quad [8]$$

- The sessions of a course must not be in a single day:

$$[9] \quad \forall i \in I,\ \forall m \in M,\ \forall l \in L_m \sum_{n \in N} x_{i,j,l,m,n} \le 1$$

- The interval between the course sessions must be at least one day:

$$[10] \quad \forall i \in I,\ \forall m \in M,\ \forall l \in L_m \sum_{n \in N} x_{i,j,l,m,n} + \sum_{n \in N} x_{i+1,j,l,m,n} \le 1$$

- Maintaining parallelism of course sessions:

$$[11] \quad \forall j \in J,\ \forall m \in M \sum_{n \in N} x_{i,j,l,m,n} \le 1$$

Furthermore, one of the unique features associated with this model is that constraints 7, 9, 10 and 11 are only applied on the courses we decide.

3.4 Objective Function

The objective function includes two terms on the basis of the cost function. The first term refers to the allocation of the course *m* to the class *n* and the professor *l*, on the day *i* at the *j*th time period. The second term is the cost of allocating the course *m* to the professor *l*.

$$Minimize\{\sum_{l\in L}\sum_{m\in M_l}\sum_{n\in N_m}\sum_{i\in I}\sum_{j\in J} s_{i,j,l,m,n}x_{i,j,l,m,n} + \sum_{l\in L}\sum_{m\in M_l} p_{l,m} * y_{l,m}\} \quad [12]$$

The decision support system generates a plan fulfilling all the above constraints, and also bearing the least cost with regard to the above objective function.

4 Evaluation

First of all, taking advantage of formal technical review, the errors within the code were detected, and the algorithms and the components of the system were also optimized. Afterwards, unit test was applied on the various sections of the system. Then through implementation of user scenarios by the system, the overall performance of the system was tested.

In order to study the results of the presented model and its performance, the industrial engineering department of Amirkabir University was selected. This department includes 24 faculty members, 32 courses and 4 classes. Subsequently, the relations between courses and professors, professors and time, and finally classes and courses were determined. The model properties after data input and their solution are provided in table 1.

Table 1: Model properties

Variable	Value
Number of primary variables	1212
Number of auxiliary variables	42
Solving time	86 ms
Number of constraints	965

As observed, the solution time of the model was only 225 ms. This model was run on a DELL inspiron 6400 model, having Windows XP, 2 GB RAM and Core 2 Duo Intel processor with 2 MB of Cash memory.

In the presented model, the number of variables has reduced considerably in comparison with the previous model. In the Daskalaki's model, for the same problem excluding the students group, 6'720 variables were required, and considering the students group, this value would reach to 19'700 variables. This is while in the proposed model with elimination of the students group and setting constrains to check the co-requisite courses and also extracting only the main variables potent to form answers, the number of main variables reduced from 19'700 to 1'212, which resulted in reduction of the memory and computational time required to come by the solution. Moreover, two sets of constraints considered to check the free times of the professors and also to maintain appropriate classes for courses were eliminated through changing the nature of the main variables, which led to reduction of the number of model constraints and finally reduction of the model size.

Other advantages associated with the current model in comparison with the previous one are as below:

- Prevention from holding two sessions of a course in a single day.
- Maintaining the minimum one day interval between the sessions of a course.
- Maintaining the parallelism of the time periods associated with the sessions of a course.

None of the aforementioned features were present prior models.

5 Conclusion

In this research, the problems associated with the scheduling process of university courses were discussed, and the scheduling problem was elaborated. Afterwards, the miscellaneous solutions to solve course scheduling problem was mentioned. Some modifications to the integer model of Daskalaki were applied, through which the size and the response time of the model and also the required memory were reduced dramatically. On the other hand, addition of some capabilities such as prevention from holding two sessions of a course in a single day, maintaining the one-day interval between the sessions of a course and maintaining parallelism in the time periods of course sessions is worthy of attention, which can be applied to desired courses.

Accordingly, some new constraints were defined, and some modifications to the previous model were introduced. Finally, this system was implemented in scheduling of the courses in the industrial engineering department of Amirkabir University of Technology.

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Using Artificial Intelligence to create a low cost self-driving car

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Abstract

This document provides information about a version of a self-driving car project which tests a new effective and inexpensive way to help the people, drive safer and faster.

Keywords: Artificial Intelligence, Self-driving cars, Traffic lanes detection, Traffic signs detection

1 Introduction

The purpose of this project is the creation of an autonomous car which should be able to drive automatically without any driver in the urban areas. Road traffic injuries caused an estimated 2.5 million deaths worldwide in the year 2004. A study using British and American crash reports as data, found that 87% of crashes were due solely to driver factors. A self-driving car can be very safe and useful for the entire mankind. In order to realize this, several concurrent software applications process data using Artificial Intelligence to recognize and propose a path which an intelligent car should follow.

The current autonomous car problem is caused by using a very expensive 3D Lidar ($ 75,000), with a very high resolution. The 3D radar is used to recognize the environment and create a high resolution 3D map. My solution is a minimal 3D Lidar that would only cost $4000 and 3 special cameras mounted to recognize from images the marker lines, borders and real time position of the car instead of the 3D radar.

The necessary power is provided by three multi-core laptops that use Artificial Intelligence for the purpose of recognizing traffic signs and localize the car on Google Maps. Using GPS coordinates each car participating in the traffic using this software will register the new signs detected and will modify the confidence degree of recognition for other users. Another software component is able to recognize the demarcation lines between lanes. It uses three cameras to calculate exactly or using probabilities the position of the car on the road, where the roadsides are and to propose a new direction even in the absence of traffic signs for the next seconds. They process the data from a 3D radar and render with OpenGL to create a 3D environment in which the car navigates, particle filters, magnetic sensors, acceleration sensors, a distributed software, a supervisory system and the software which drives the stepper motor to turn the steering wheel (acceleration and braking).

This document is only a summary from a 120 pages research paper which was presented at Intel International Science and Engineering Fair 2013 Phoenix, US.

2. Project's diagram

In the following diagram you can see my autonomous car design. The car contains two cameras designed so as to be able to spot the lanes from left and right. Another camera is placed in the driver's position in order to be able to spot the traffic lanes and traffic signs as if viewed by a normal driver. The 3D radar, called also Rangefinder or LIDAR, is attached to the car to create a

3D model, including a real-time model of the environment. The 3D information, traffic lanes and the traffic signs will be used by the supervisor software in order to calculate the collisions and the car's path.

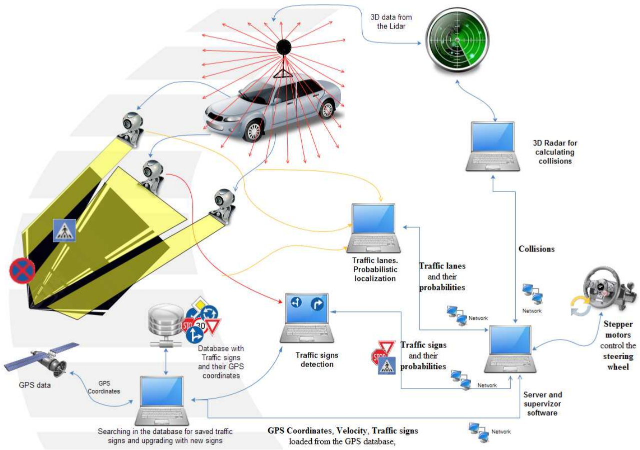


Figure 1. The self-driving car diagram – Artificial Intelligence calculation is provided by three different laptops. The supervisor software component will quantify all of the processed data by all other components and it will be able to turn the steering wheels in order to maintain the car on the street/ road.

3. Traffic lanes Detection

The software is able to recognize the demarcation traffic lanes on the streets. The algorithm is a unique method that recognizes traffic lanes using three different webcams. Two images were taken from the left and right side of the car. Another image was taken from a webcam placed in the position of the driver to spot the demarcation lanes from the top view. The software is able to compute the distance between the lanes and the probability how close are the car's wheels to traffic lanes.

A particle filter(Monte Carlo) is used in statistics as a sophisticated mathematical estimation technique based on a long time simulation (called also tracking). The main idea is that the traffic lanes are continuous and they don't disappear in a few seconds and appear again. Particle filters are usually used to estimate Bayesian models in which the latent variables are connected in a Markov chain.

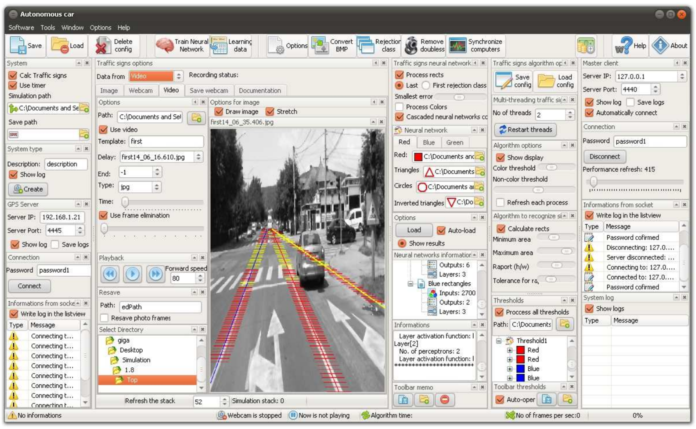


Figure 2. The software which is able to recognize the traffic lanes from images and correct the direction path of the car in order to keep the car on the street

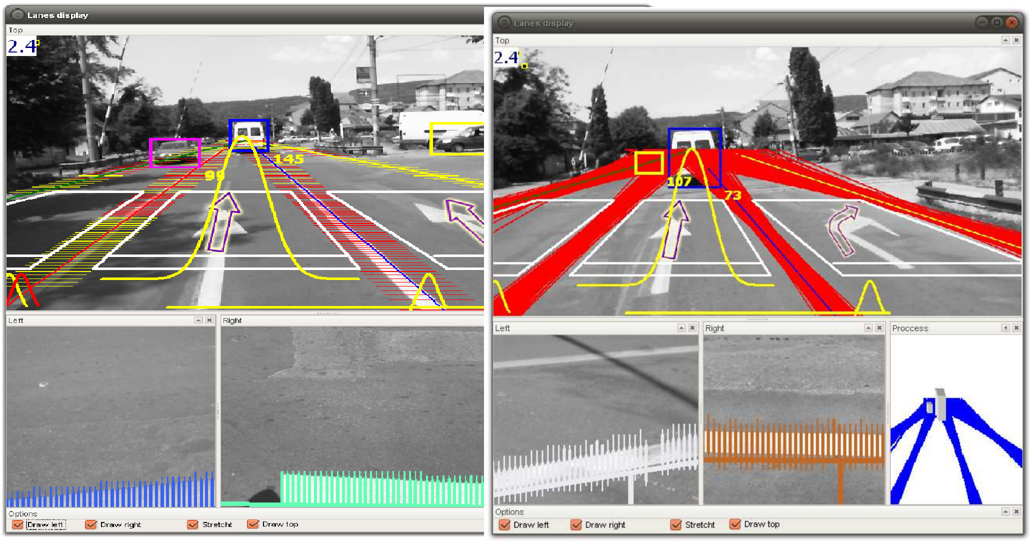


Figure 3. Different results from simulations through Rm. Valcea

4. GPS Software

Sometimes the detection of the traffic signs cannot be done accurately because obstacles such as trees or people may cover the traffic signs. To avoid this and to increase the traffic signs recognition, all autonomous cars collaboratively will try to create a common database with all traffic signs and their GPS position. Using this common database, every time an autonomous car drives, the GPS Software component will update the database with new traffic signs and the supervisor software will receive the storage traffic signs from that GPS position.

The traffic signs from the common database have a very important property namely: feedback. The feedback allows me to create a probability of certainty for the traffic sign stored in the common traffic signs database.

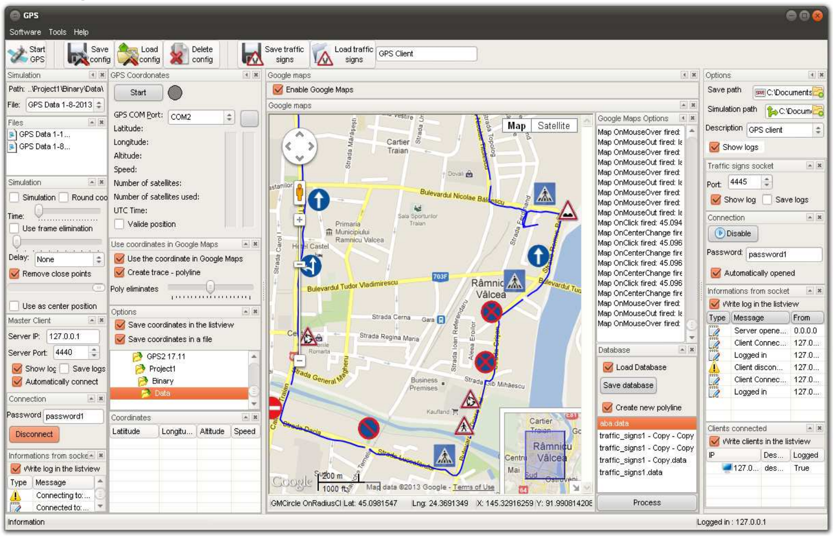
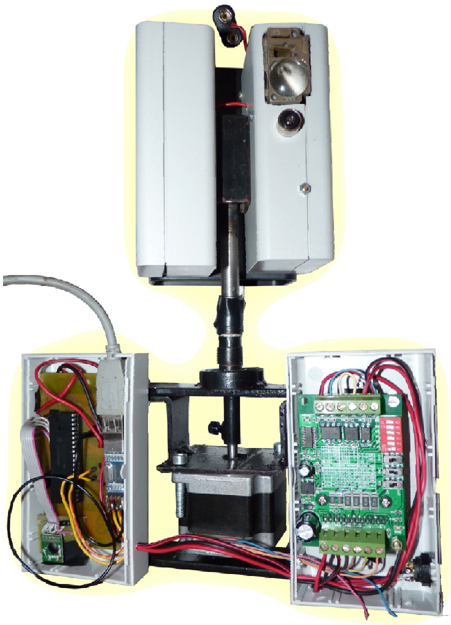


Figure 4. The blue line is the path of the car. The traffic signs were the signs recognized in real time by the software and stored in the common database

5. 3D Lidar

This project presents a hardware version of a LIDAR – a 3D radar and a software for creating a 3D environment in which the car navigates. By using it, the car will take the decision to avoid obstacles. The 3D radar helps the entire software system to increase the confidence of decision.



6. 3D Lidar software

The data is sent via RS232 serial port. I realized also a software that is able to read the that from COM ports and to send the 3D Data to the supervisor software.

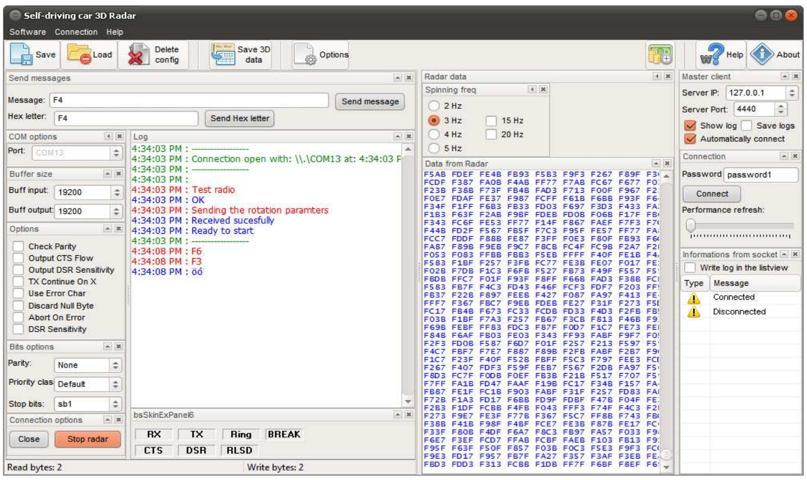


Figure 7. 3D Lidar software – which is able to read the data from the Lidar

7. 3D Lidar map software

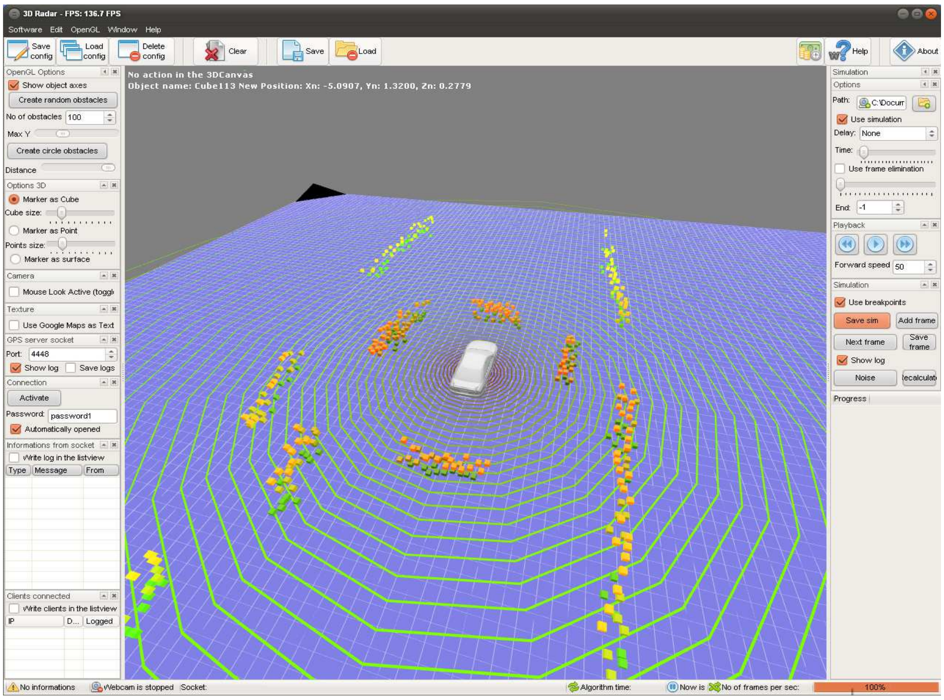


Figure 8. Generated map, the cubes mean obstacles; there are 5 cars in the map

Another software component was intended to create a 3D map (using the OpenGL technology) then use it to debug and understand the 3D data from the Range Finder (LIDAR). The 3D data is read using the serial protocol RS232 and processed by this software. The software is also able to connect to the supervisor software and to receive further instructions from it. As the 3D radar hasn't been finished yet, in the following image you can see a random 3D map using a 3D random data. In the picture, a dot is a 3D obstacle situated at a distance X. The distance of the obstacle is described by the color of the dot.

8. Supervisor software

The supervisor software it is the software which collects the data from all other software components and is able to calculate the decisions of the car path in order to maintain the car on the road. Furthermore this supervisor software is able also to synchronize the software components and is used to start and to control all other software components (Traffic signs, Traffic lanes recognition, GPS Software, 3D Radar software) from distance.

The communication was made using my own Protocol and uses a local wireless connection. In a summary statement this master software is able to collect the entire data from all other software parts and to make the decisions of the car's path.

The master software creates a Model Based Design graph to illustrate the current status of the other software components. Using the drag & drop technique the user is able to control the software components from distance.

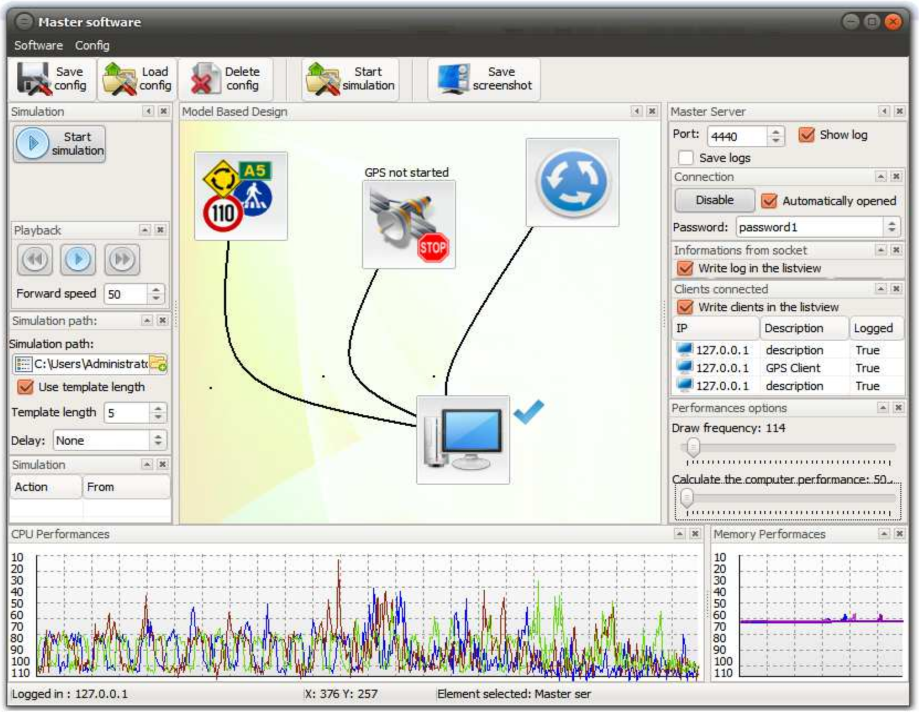


Figure 9. Screenshot of the supervisor software

9. Electronic part

This project presents a hardware version of a LIDAR – a 3D radar and a software for creating a 3D environment in which the car navigates. By using it, the car will take the decision to avoid obstacles. The 3D radar helps the entire software system to increase the confidence of decision. A stepper motor is used to spin the PCB with the photodiodes, alimentation and a PIC16F877. A photodiode is a type of photodetector capable of converting light into either current or voltage. My photodiode is a very special one and is used only in rangefinder; it is an **APD – Avalanche Photodiode Detector –** source at **200 V.**

Data received: No. of APDs*No of spins per second*No. of spin grades*No. bits
16 x 10Hz *180° (or 360 or 1800)*10 bits = 288,000 bits of data/s 28.800 pixels with the resolution of 10 bits

For the current version of the 3D Lidar, there are only 6 electronic parts:

1) Base microcontroller, driving stepper – LIDAR, interface for RS232
2) LIDAR microcontroller – fast convertor analogical digital SPI, wireless transmitter
3) Convert the ToF(Time of Fly) into an analogical signal.
4) Clock generator – 4 kHz, 0.001%, length of duration ~ 40 ns
5) Pulsed laser generator, 35A/40-60 ns
6) APD photodiode, comparator and high speed A stable

9.1 Convert the ToF(Time of Fly) into an analogic signal.

The electronic circuit calculates the time difference between the pulse and reception of the reflected signal from the target. For this I used a D flip-flop. The resulting signal is integrated with a high-frequency integrator, then is applied to a sample and hold circuit created from a switch

CD4067 and a repeater. The circuit returns a voltage proportional to the pulse duration. I used this method because the analog digital converters require conversion voltage to be stable at least for one microsecond.

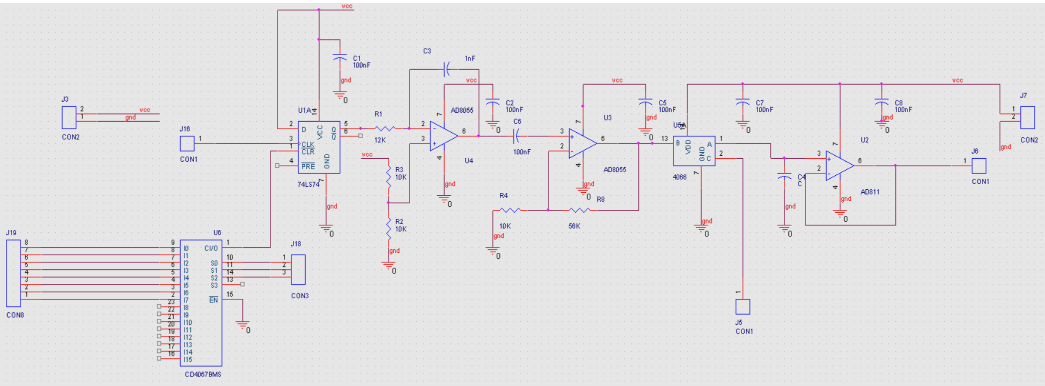
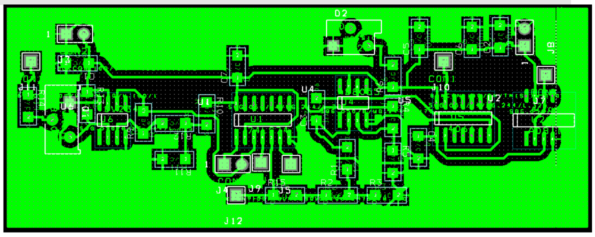


Figure 10. The time of flight convertor electronic schematic



10. lts

Most of the project's components have been done. The software is able to recognize the traffic signs and register them in a common database using Google Maps and GPS. The GPS software component records the signs and direction of travel from that area. Each car participating in the traffic using this software will register the new signs detected and will modify the confidence degree of recognition for other users. Another software component is able to recognize the demarcation lines between lanes. It uses three cameras to calculate exactly or using probabilities the position of the car on the road, where the roadsides are and to *propose a new direction* even in the *absence of traffic signs*, *traffic lanes* for the next few seconds. Another part of the software uses Artificial Intelligence to detect other car fingerprints from webcam images.

The algorithms were implemented parallel and distributed. I developed a management software system based on semaphores that allows data processing and supervision from 5 different computers with multiple cores.

This project contains also a home-made LIDAR – a 3D "radar" and a software using OpenGL to create a 3D environment in which the car navigates. By using it, the car will take the decision of avoiding obstacles. The 3D Lidar helps the entire software system to increase the confidence of decision.

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The Management of a Succesful Project

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Abstract

The role of this paper is to present the activity of the ‘Multitouchcnme Team’ of trans-disciplinary research workshop from ‘Mihai Eminescu’ National College in Satu Mare in the ‘Learning for knowledge society’ project implemented by the Project Management Unit with Foreign Finance-Education Ministry in partnership with SIVECO ROMANIA and ‘Carol I’ National Defense University, which has involved an inter/trans-disciplinary project contest. The ‘Multitouchcnme Team’ has won first prize for the N-V region, with our school wining a multi-touch laboratory. The theme we have developed our project on is quite generous and is set on a trans-disciplinary paradigm, which is mankind’s dream to fly. The project put forward by SIVECO ROMANIA has reached the finals in the Project World Championship: IPMA International Project Excellence Award 2013.

Keywords: levels of Reality, the logic of the included middle, complexity, multidisciplinarity, interdisciplinarity

1. Introduction

In his study ‘**Crisis of the spirit and other essays’**, Paul Valery cautioned about the fact that the European spirit ‘is shaking between two abysses, because there are two dangers that do not cease to threat the world: order and disorder.’ (1). We are being witnesses to a de-structuring of the old world, visible in all of life’s registries, a transition towards new paradigms, these being cognitive *pattern*, axiological, epistemological. Gilbert Durand talks about ‘the civilization of imagery’ and M. Maffesoli about the ‘Galaxy of the Imaginary’ which opposes aggressively the ‘Gutenberg Galaxy’ while Alvin Toffler calls it ‘The Third Wave’ of cultural paradigm, marked by the globalization phenomenon and the transfer towards a civilization where knowing and processing information and communications is decisive. Globalization has led to a spectacular leap of development of a more informed society, promoting a new concept of ‘society of knowledge’. In this context, many new roads open up to the modern Theseus Teacher who goes into the labyrinth of didactical projections with the wish of touching the *Revelation-Center.* On such a trajectory, the Teacher of the 21st Century try to lend to himself the perspective of his own vision, is reformed to become a ‘Coach of the spirit’ (C-tin Noica), Mediator between the Subject and the Object of the research, his aim being ‘cultivating the creative potential of youngsters, getting them ready for a society in which integrating technology can contribute to the development of their success’. (2). The ‘Learning for the knowledge society’ project which was implemented by Project Management Unit with Foreign Finance-Ministry of Education in partnership with SIVECO ROMANIA and the ‘Carol I’ National Defense University (December 2009-November 2012) is set on the path of European framed Programs for research and innovation, provided in the Treaty of Lisbon, in the politics promoted by the European Research Area (ERA), stating the constructivist paradigm, the inter and trans-disciplinary strategy and the use of ITC in the educational process. Since the Renaissance until nowadays, physics has offered the model of understanding the world and society. **Quantum physics, the anthropic principle and the**

holographic paradigm open up a new vision of the world, of mankind and of knowledge with immediate effects in the field of education. The educational paradigm of the 21st Century which is synchronized with the spirit of the times, informatization, suggests that a viable solution is focusing on the student by integrating technology and by using the integrated curriculum and a constructivist approach. The integrating vision comes from the trans-disciplinary model, creating added value to the education. We can see a new approach in the transdisciplinary trend, aimed at knowledge, situation learning not in disciplinary constrains, but 'in' integrating global education, which values 'what is at the same time between disciplines and inside diverse disciplines and beyond any discipline. Its finality is understanding the present world, one of its imperatives being the unity of knowledge' (3). The transdisciplinary approach brings forward a new methodology of knowledge which admits the existence of levels of Reality, **the logic of the included middle,** and **complexity.**

2. THE DREAM OF FLIGHT

2.1. Universe. Flight. Aviation

'Once you have tried flying, you will forever step on Earth with the eyes aimed at the sky, where you have been and you will always want to go back'
(Leonardo Da Vinci)

In 2010 we have started our trans-disciplinary flight adventure, after seeing the project proposed by SIVECO ROMANIA, the Education Ministry and Carol I University, 'Learning for the society of knowledge'. Then came the fascinating challenge of the National Inter and Transdisciplinary Project Championship under the same coordination, where the ***Multitouch CNME Team*** from our College has taken part with the '**Man from earth to sky-flight-aviation-Universe'** project which has won with maximum points (100) and the multi-touch laboratory in a competition where 135 applications have been evaluated. After winning this competition, our College received and installed a multi-touch laboratory with all its afferent logistics, operation which took part in August 2012. We have all been and are fascinated by what hides beyond the clouds. We have not chosen this subject randomly, but because it fulfills the expectations of teenagers. Firstly, flying is the feeling of supreme liberty, movement in all three dimensions of space. Then, defying gravity and mostly landing on the ground safely probably means the supreme challenge of our civilization, probably one of the most complex problems solved by mankind. For 100 years, Aerospatiale Engineering has won its reputation of the spearhead of technology. Flight has made distance redundant, provoking a mass movement of people which has never before seen in the history of mankind of such a nature that it got anthropologists interested as well. Aerospatiale technology has totally changed most of the paradigms of the modern world, the ways wars are fought, concepts of defense and security. The subject offers multiple potentials: opens meditation subjects, reveals new career opportunities-aviation is an elite profession where you get into contact with the very best technology, a professions which does not accept dilettantism, does not accept compromise, because any mistake is paid with innocent blood. Aviation is a passion, but based on science –and a world where only those already initiated can have access. Lastly, the subjects offer models, because it has always attracted professional elites, every pilot having Icarus inside him. Students feel an attraction to flying '*because you can easily develop a passion for this profession: it is entertaining, fascinating, it is pretentious and provocative (because of the complexity and adversity of the environment); it is a profession which differentiates (the personal strategy of pilots should be the differentiating aspect), international demand is on the rise (the trend is promising)'* as one of our experts, Octavian Thor Pleter says. This is the reason why we believe this subject was worthy of being part of the school curriculum for the optional 'Learning for the knowledge society' module, aviation being an elite field, with the ability to have a major impact in the personal and professional defining of students.

2.2. How The Team Was Formed....

The multi-touch module was a gift I have been waiting for years. This is why in the autumn of 2010 I have offered my colleagues and students the chance to join the Multitouchcnme Team, to be able to configure the participating project. As a coordinator of the team, I have suggested the subject, vision and project strategies, and negotiated them with all the team members. My dream was 'contaminating', thus **the *Multitouchcnme Team*** has over 200 student members and an impressive number of teachers. The transdisciplinary paradigm in education imposes the presence of mentors, as Basarab Nicolescu has said on many occasions, because any rite of passage is presented with the help of the mystagog (can you remember Tarkovski's famous movie, Stalker?). The complexity of the team and the fears of our dilettantism in a field which is not exclusive to our expertise have determined us to compensate all these with a massive intervention of experts in the field of aviation: Dumitru Prunariu, Alexandru Mironov; Octavian Thor Pleter– Prodecan, the Aerospatiale Faculty of Engineering, Bucharest, Radu Cioponea – Senior Expert Safety, EUROCONTROL, Belgium; Catalin Prunariu –TAROM Captain; Marian Stan - engineer, Continental Division Chassis & Safety Frankfurt a.M., Germania, Tiberiu Iosub - Cabin appearance specialist - Emirates Airlines; Dumitru Oprisu – A 380 Captain, Emirates Airlines; Dorin Ivascu - Manager Aeroport Băneasa S.A. The dialogue with the pilots has enriched us on every level, messages extended to concrete plans, either on the website forum, or on the private address of the Team, or with the visits we have received at our school, in webinars. A special experience was when we took part in the Air Navigation Convention in 2010-2013, event which has been organized by EUROAVIA and the Faculty of Aerospatiale Engineering where we have had the chance to meet some of the mentorsand directly learn the lesson of leadership from them. In the 2010-2011 school year the Team had to operate outside of the allocated school classes because of very tight scheduling. Starting from 2011-2013, the Multitouchcnme Team was able to operate as an Excellence Circle, in parallel with the optional included in the CDS offer, aimed at XI-th grade students from all profiles in the highschool, but also extended to grades VII-VIII. From 2013-2014 the Team will broaden its ranks by being included in the County Circle of Excellence. The internal organization of the Team has meant even from the very beginning the creation of several departments: **Documentation, Creative and Software**, each having a coordinator among the students, which helps them develop managerial abilities, taking responsibilities, creating initiatives, teamwork, takes delegation and more importantly, ensuring deadlines are met. We have functioned as a mini-multinational company on the basis on shared values.

2.3. Personalizing The Project

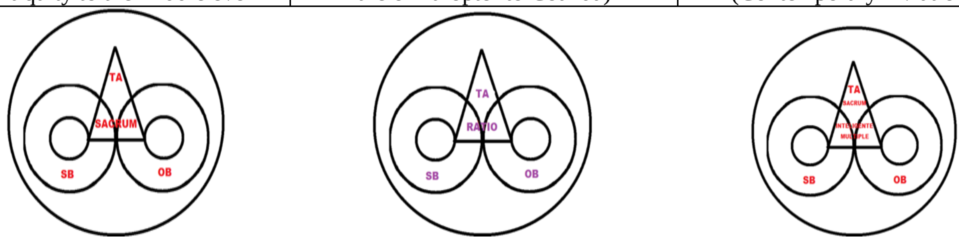
With the proposed subject, we have tried to add value to fields of knowledge of great interest for teenagers, such as the **Universe- Flight- Aviation**. The approach has been transdisciplinary because if fits our constructivist paradigm and has allowed to achieve the project in a SEI format, this being our major objective. The philosophy on which we have built our internal structure of the subject focuses on forming transferable competences and is articulated on the Sacred-Ratio-Sacred/Multiple Intelligences ternary in an endeavour marked by what B. Nicolescu calls subjective objectiveness and objective subjectivity. The finality of this aimed a complex set of values and attitudes, found in a frame-programme generating an trans disciplinary attitude, characterized by rigour, openness and tolerance (4), a proactive attitude, dynamic, open-minded, valuing toe creative potential of everyone and personal experience, having a dominance in developing abilities of 'high class' and cross-curricular, of learning competences, informing, thinking, communicating, cooperation, work, adaptability, meaning all those competence categories specific to youngsters of the 21st century. We have thus offered students a flexible approach in formal contexts (school, laboratory), non-formal (extracurricular) and informal (multiple information mediums), as well as a way of freely-consented evaluation. The proposed didactic strategies were subordinated to the constructivist paradigm, being student centered, which build its own knowledge, reflects in a lucid way on the experiences they dynamically go through, and in this case the teacher is simply a guide, mentor and partner. The thematic unity was generated starting from the relationship between man-universe-flight. Structurally, the theme is articulated on three main subthemes, developing two or three approach and research modules:

1. **'The dream of flight'** illustrates the time before the first defeats of gravitation.
2. '**Fulfillment of the dream'** reflects the time of the first flights, first airplanes and first balloons, to the era of jet engines.
3. '**It's even better than we dreamt'** is about the contemporary period.

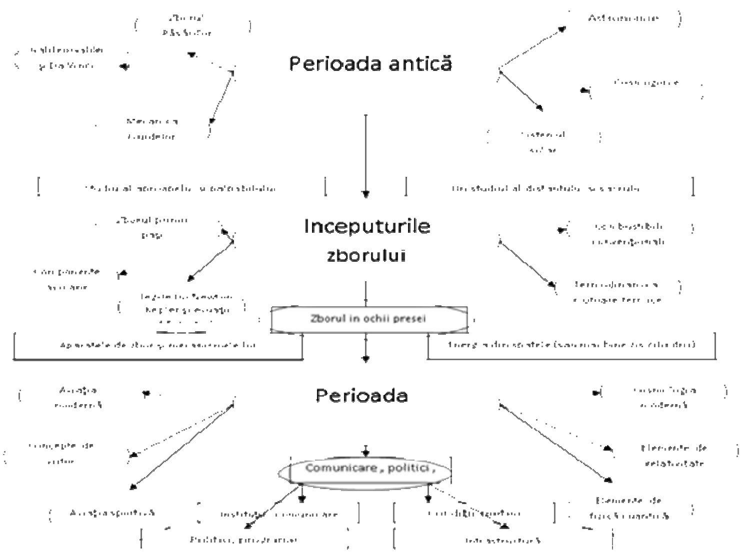
Our preoccupation even from an incipient phase was to identify in a realistic way the internal, trans disciplinary structure of the subjects, as we did not want to fall into the disciplinary side of things. Our clear intention was to stay within the spirit of the trans disciplinary scheme: Subject-Object-Hidden third party, brought forward by B. Nicolescu:

"Table 1. The transdisciplinary scheme"

Subtheme 1	Subtheme 2	Subtheme 3
The dream of flight (from antiquity to the middle eve	The fulfillment of the dream (from the ornithopter to Coanda)	It's better than we dreamt (Contemporary Aviation)



"Table 2. Conceptual map of the subject "



In the step before elaborating the internal structure of the subject we have used ways of clarifying the content:

“Table 3. Generating Matrix ”

	Man	Resources	Survival	Hazard	Science
Man	1, 2	3	5, 7	3, 4	3, 5, 6, 7
Resources	5	3	7	1, 8	3, 5, 7
Survival	1, 4	5, 9	1	3	5, 9
Hazard	1	5	1	3	5
Science	1, 4, 5, 6, 7, 10	3, 5	5, 7	1, 3	1, 3, 5, 6, 7, 10

1. Communication Institutions
2. Career orientation
3. Eppur si muove
4. Sport Aviation
5. Modern flight-from ordinary to future projects
6. From earth to skies
7. Arts and mechanisms of the classic flight
8. Weather
9. Eco fuels
10. Cosmology-present and future

The thematic unity, ‘**Man from the earth to the skies’** integrates in an organic structure which coagulates three extra themes which will be reflected in a polyhedral way: ‘**Oceanography-following the steps of Jacques Yves Cousteau’**, **‘Journey to the center of the earth’ following Jules Verne** and ‘**Valences of Fire’** integrating in the end the trans disciplinary study of the four elements on the subject of ‘**Universe-miracle and science’**. Only then will we be able to have an integrating, organic, complex and integrating perspective, unified by the Hidden Third party which is the Sacred.

3. WEB. ADJACENT PROJECTS

The thematic corpus we have suggested for the competition was thought from the very beginning to be a nucleus which generates other projects, thus we have managed to develop a true network:

- For the ‘Communication. Institutions. Career orientation’ sections we have generated the ‘**New Generation’** project, with the webpage: http://proiectnewgeneration.wikispaces.com/ . This is part of the ‘Activities to develop life abilities project’, POSDRU, enabled by MECTS. In an economy which is extremely competitive, students must be ready to face the challenge of learning throughout their lives and implicitly to be able to adhere to the labor market. The activities and sections of the blog are aimed at personal development and career orientation: coaching, office documents-CV Template, letter of application etc, presenting techniques for interviews, work legislation, openings in specialist HR website, problems with different lifestyles and its influences on future career options, individual and group projects on gender equality and many others.
- **The story teashop –**with the address https://www.facebook.com/pages/CEAINARIA-CU-POVESTI/189972414399282 - is a virtual lecture space, a place for students to gather and chat with writers, artists, musicians. In the Teashop we experiment with the sincretism of arts and practice creating writing. Implicitly, it is an informal means of evaluation.
- To promote the Team’s projects and to keep in touch with our mentors and experts, we have created the Facebook Page:

Team Multitouchcnme:**facebook.com/mutitouchcnme**

- **Flight: http://echipamultitouchcnme.blogspot.ro/** is a thematic blog, specialized in Language and communication-Man and society, containing information about the theme of the project from: Mithology, Literature, Religion, Philosophy, Astrology. Furthermore, here you can download our college magazine, ‘Luceafarul si noi’ in an electronic format.
- The CNME Astronomy Club http://www.astrocnme.blogspot.ro/

4. Teaching – Learning-Evaluative Methods, Procedures and Strategies

'In never teach lessons to my students. I only offer them the means to learn on their own.' (Albert Einstein)

On the teaching stage, both students and teachers are actors of the same play. With the paradigm change of the educational system, the teacher of the 21st Century needs to be both director and actor at the same time, but also creator and offer incentives for students to start thinking for themselves in a reflective, motivating way. The suggested theme imposes that teaching is centered on the student, while they build their own knowledge by direct observation, through individual investigation, by selecting and generalizing. In this context, we have suggested: diversifying the teaching tasks, strategies, procedures and methods to develop trans curricular competences found in the PISA tests, Intel Teach Projects, E-Twinning etc. Adding value to personal experience, using methods of critical thinking, using modern technology, initiating some transversal cross-curricular actions. The generalized method is that of the project: Diversify the teaching tasks; Identify new strategies and methods to fulfill the expectations of the student of the 21st century ;Introduce new strategies, procedures and methods that will develop the trans-curricular competences found in the PISA tests; Develop new Intel Teach projects, E-Twinning etc; Extract value from all ways of teaching: formal and non-formal, informal, outside of school etc.; Have a reciprocal teaching strategy ; Extract value from personal experience; Use **methods of critical thinking**: analyzing problems, the Venn diagram, case study, graphic charts, conceptual maps, exercise, brainstorming, brain-writing, role play, dream technique, the multiple intelligence method, reflection journal, chameleon journal, tour of the gallery, the quintet, free writing, the graffiti method, modeling etc; Use of **modern technology**; Initiate transversal, cross-curricular actions. For this, we would recommend: creating of networks which have the goal of obtaining a regular exchange of best practice; individual and group research; have direct meetings with the experts; -have videoconferences with the experts; have experiments, case studies, debates in the World Schools format. The lessons are based on multiple scripts, on varied methods, opening many new learning opportunities. The students are organized in such a way that they can work in teams. The generalized, integrating method of work will be that of projects, a complementary learning/evaluating method, promoting experience-based learning and collaborative learning. The finality of the project is an IES-Interactive Educational Software. The project involves forming transferable competences: developing initiative and creativity, investigation, generalizing, application, team work, integrating personal experience within the overall experience of the team, developing competences to use new technologies. The work tool is the computer, while the Internet is quickly becoming a good information source.

5. Performances

Besides managing to win the multi-touch laboratory, the project was disseminated during important events: 'Air Navigation Convention', Bucharest 2011-2013, Workshop etc. Personally, since 2010 when I first started to better understand the trans disciplinary paradigm, I have been on a truly rite of passage, rediscovering skills I thought were long forgotten, and I have been able to reposition myself alongside the Universe. In my opinion, multi-touch is the most creative, offering, and provocative project possible. We are proud to have been part of it, proud that we have become CHAMPIONS, that we are among those who write the history of trans disciplinary study in Romania.

"*Educational process aptimized in view of competence within a knowledge based society*" Project, Siveco Romania and Education Ministry.

Gold Award at the Project World Championship: IPMA International Project Excellence Award 2013.

Ref.: http://ipma.ch/award-news/ipma-announces-winners-of-the-project-excellence-award-2013/

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Using Excel Spreadsheets to simulate the Electric Circuits of Alternating Current

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Abstract

This paper presents an instrument used to simulate the RLC series circuit of alternating current utilizing Excel spreadsheets. There are highlighted the facilities offered by spreadsheets both for the calculus of measures specific for the alternating current, and for the graphic representations. There is a detailed presentation of the design of the instrument with the aid of the functions placed at disposal by the program Microsoft Excel. The instrument is useful both in teaching and learning, and it can easily be adapted in other situations.

Keywords: Spreadsheet, Excel, Alternating Current, RLC circuit, Physics.

1. Introduction

The results of tests applied in a series of countries have shown that students possess certain erroneous conceptions when it comes to interpreting measures and phenomena connected to electric circuits (Shipstonet et al. 1988; Sencar, 2004).

A study guided by the constructivist theory that focused on students’ understanding of the electric circuits has been carried out by D. P. Shepardson and Elizabeth B. Moje. At the end of a training unit, after the interviews taken to each student from a tested batch, the conclusion was that electric circuits have been understood more easily from a technical point of view, but there have been some major difficulties in the correct scientific understanding of the electric current. Consequently, it has been stated that for an effective teaching process, and, respectively, an objective assessment, a restructuring of acquisitions is imposed (Shepardson, 1994). Also, it frequently happens for students to have some wrong conceptions even after the instruction, a concrete example being the confusions between current, voltage and electric resistance (Engelhardt, 2004).

Following the direction of the constructivist approach, the spreadsheet can represent both an efficient modeling and a simulation instrument for the study of electric circuits, and any teacher can apply diverse models of tabular calculus for simulation (Silva, 1994); at the same time, the spreadsheet can be used to help students learn about the electric circuit (Kellog, 1993).

The advantages of spreadsheets, from the simple user-friendly interface, to the rapid feedback when changing data and the large number of functions at the user’s disposal, have been presented in a series of papers (Cooke, 1997; Subedi, 2007) and need no further emphasis.

It needs to be noted that modern spreadsheets contain a macro language that allows users to include programs specific for their operation, such as Visual Basic for Application (VBA) for Microsoft Excel. In this respect, M. Aliane’s article describes how Microsoft Excel can be used as an alternative platform for the development of interactive learning instruments in the educational field (Aliane, 2008).

The present paper develops an instrument for the simulation of the RLC series circuit of alternating current with the aid of the Excel 2010 spreadsheets. There are exploited both the calculation capacities in Excel, and the graphic facilities offered by this program. Thus, with the help of the input data, we obtain two categories of results, on the one hand constant measures connected to the electric circuit, and on the other, variations of measures according to time, visualized through associated graphic representations.

2. Theoretical background

The RLC series circuit consists of a grouping made up of a resistor with electrical resistance R, an inductor with inductance L and a capacitor with capacitance C, all connected in series to the terminals of the AC voltage source. We consider that the inductor and the capacitor are ideal, meaning lacking electric resistance.

By applying a sinusoidal alternating voltage, u(t), to the grouping, in the form:

[1] $$u_t = U_m \sin \omega t$$

the current through the circuit, i(t), in a permanent state is also sinusoidal, so that we can write:

[2] $$i_{(t)} = I_m \sin\left(\omega t - \varphi_0\right)$$

where ω represents the angular frequency of the voltage applied, U_m, I_m the maximal values of the voltage, respectively of the sinusoidal current, φ_0 the phase angle between voltage and current, t the time variable.

The angular frequency is connected to the period, T, and the physical frequency, f, by the relation:

[3] $$\omega = 2\pi/T = 2\pi f$$

The link between U_m and I_m is:

[4] $$I_m = U_m / Z$$

where Z represents the impedance of the RLC series circuit, function of parameters R, L, C of the circuit and the angular frequency ω:

[5] $$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

The measures:

[6] $$X_L = \omega L$$

[7] $$X_C = 1/\omega C$$

represent the inductive reactance, respectively the capacitive reactance of the RLC series circuit.

The phase angle between the voltage applied to the terminals of the grouping and the current through the circuit, φ_0, is given by the equation:

[8] $$tg\varphi_0 = \frac{X_L - X_C}{R}$$

According to the values of the two reactances we have the following three situations:

- $X_L > X_C$ we obtain $\varphi_0 > 0$. In this case the inductive reactance prevails and the current through the circuit is phased as a consequence of the voltage applied to the terminals of the grouping;
- $X_L = X_C$ we obtain $\varphi_0 = 0$. In this case the inductive reactance and the capacitive reactance compensate each other and the circuit has a purely resistive behavior, thus resulting the resonance phenomenon;

- $X_L<X_C$ we obtain $\varphi_0<0$. In this case the capacitive reactance prevails and the current through the circuit is phased before the voltage applied to the terminals of the grouping.

The resonance frequency, f_0, is immediately obtained from the equality of the inductive and capacitive reactances:

[9] $$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

At the resonance, the impedance of the circuit becomes minimum, equal to the resistance of the circuit, Z=R, and the electric current through the circuit, I_{rm}, becomes maximal (Nicula et al. 1982):

[10] $$I_{rm} = U_m / R$$

The quality factor, Q, of the circuit is:

[11] $$Q = \frac{1}{R}\sqrt{\frac{L}{C}}$$

From an energetic point of view, we can characterize the alternating current circuit through several types of powers. For the following ones, we only state the types of powers, specifying the corresponding calculus relations. We have:

- Instantaneous power, p(t)

[12] $$p_{(t)} = u_{(t)} \cdot i_{(t)}$$

- Active power, P_a

[13] $$P_a = (1/2)\, U_m I_m \cos\varphi_0$$

- Reactive power, P_r

[14] $$P_r = (1/2)\, U_m I_m \sin\varphi_0$$

- Apparent power, S

[15] $$S = (1/2)\, U_m I_m = \sqrt{P_a^2 + P_r^2}$$

The significance of the measures that intervene in the equations [12]-[15] is that of the previous formula [1]-[8].

The current-voltage diagram phasor, the physical interpretation and other observations connected to powers are presented in any introductory course of Physics that treats the circuits of alternating current and need no further emphasis (Nicula et al. 1982; Purcell 2013).

3. The “RLC Simulation” Instrument

With the aid of the “RLC Simulation” instrument we can simulate the behavior of an RLC series circuit of alternating current. Knowing the maximum voltage applied to the terminals of the circuit, the physical frequency of the voltage applied and the parameters of the circuit, the resistance of the resistor, the inductance of the inductor and the capacity of the capacitor, we can determine the maximum current through the circuit, the phase angle voltage-current, as well as other measures, but, at the same time, visualize the voltage, current and instantaneous power curbs, according to time, observing how they are phased in relation to one another. Both the inductor and the capacitor are considered ideal, therefore lacking electric resistance.

The instrument is made up of the main calculation spreadsheet rendered in figure 1 with the sections “Data Input” and “Results”, plus a secondary spreadsheet that contains the source table for the charts placed in the main spreadsheet next to the two sections.

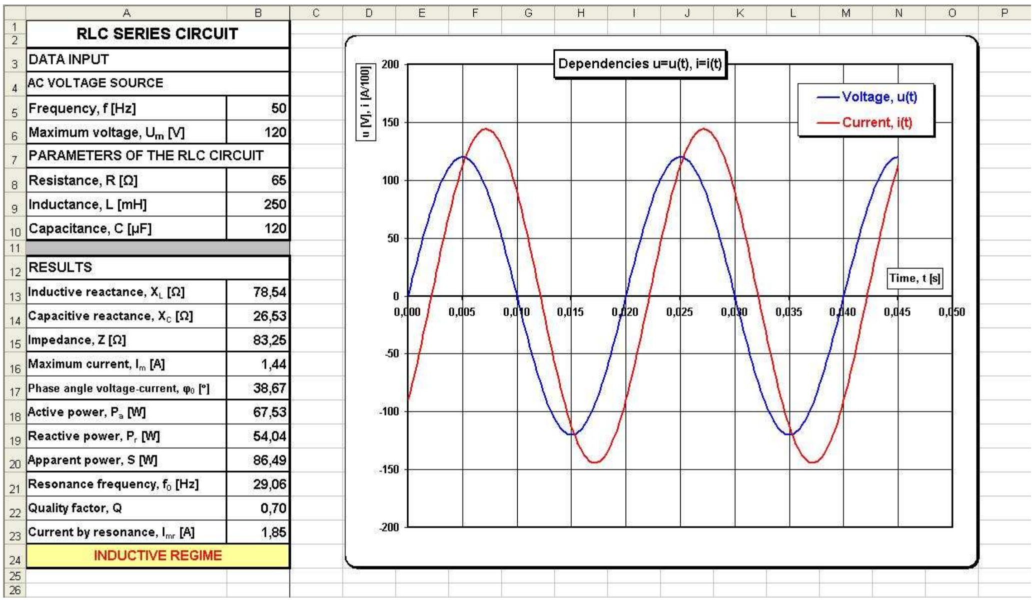

Figure 1. The main spreadsheet of the instrument “RLC Simulation”

The section “Data Input” comprises two subsections, namely, one connected to the measures characteristic to the source, entitles “AC voltage source”, and a second one connected to the elements of the circuit exterior to the source, entitles “Parameters of the RLC circuit”. In the first subsection the following data are introduced: physical frequency of the voltage applied, f, expressed in Hertz (Hz) and the maximum voltage, U_m, applied to the terminals of the grouping, expressed in Volts (V). In the second subsection the following data are introduced: the resistance of the resistor, R, expressed in Ohms (Ω), inductance of the inductor, L, expressed in miliHenries (mH) and the capacity of the capacitor, C, expressed in microFarads (μF).

In the section “Results” we obtain the calculated values, according to the data introduced in the first section, for: inductive reactance, X_L, in Ohms, capacitive reactance, X_C, in Ohms, impedance of the circuit, Z, in Ohms, maximum current in the circuit, I_m, in Amperes, the phase angle between voltage and current, φ_0, in degrees, the active P_a, reactive, P_r, and apparent, S, powers in Watts, the resonance frequency of the circuit, f_0, in Hertz, the quality factor of the circuit, Q, the current through the circuit at resonance, I_{mr}, in Amperes. Under the table of calculated values, in an extended cell, it is displayed the type of regime in which the circuit works, namely inductive or capacitive regime or resonance regime according to the entry data.

In order to make the calculation more comfortable in Excel and intervene more easily in the case of errors, we name the cells where the data are introduced together with some cells, in which the results are displayed, also constituting, in their turn, data in the calculation of other measures, in conformity with the table below:

No.	Cell	Name	No.	Cell	Name
1	B5	Frequency	6	B13	Reactance_L
2	B6	Voltage_Max	7	B14	Reactance_C
3	B8	Resistance	8	B15	Impedance
4	B9	Inductance	9	B16	Current_Max
5	B10	Capacitance	10	B17	Phase_angle

Table 1. Names of cells in the main spreadsheet

Next, with the notations we introduced, taking into account the equations [4]-[15], we have rendered the transcription in Excel for the calculus of the following measures:

- Inductive reactance, X_L, in cell B13: "=2*PI()*Frequency*Inductance*10^(-3)'', where we multiplied with 10^{-3} to transform from mH to H;
- Capacitive reactance, X_C, in cell B14: "=1/(2*PI()*Frequency*Capacitance*10^(-6))'', where we multiplied 10^{-6} to transform from μF to F;
- Impedance, Z, in cell B15: "=SQRT(Resistance^2+(Reactance_L-Reactance_C)^2)'';
- Maximum current, I_m, in cell B16: „=Voltage_Max/Impedance'';
- Phase angle between voltage-current, φ_0, in cell B17: "=DEGREES(ATAN((Reactance_L-Reactance_C)/Resistance))'';
- Active power, P_a, in cell B18: "=(1/2)*Voltage_Max*Current_Max*COS(RADIANS(Phase_angle))'';
- Reactive power, P_r, in cell B19: "=(1/2)*Voltage_Max*Current_Max*SIN(RADIANS(Phase_angle))'';
- Apparent power, S, in cell B20: "=(1/2)*Voltage_Max*Current_Max'';
- Resonance frequency, f_0, in cell B21: "=1/(2*PI()*SQRT(Inductance*10^(-3)*Capacitance*10^(-6)))'';
- Quality factor, Q, in cell B22: "=(1/Resistance)*SQRT((Inductance/Capacitance)*1000)'', where we multiplied with 1000 taking into account that the inductance is expressed in mH and the capacity in μF;
- Current at resonance, I_{mr}, in cell B23: "=Voltage_Max/Resistance'';

To display the type of regime in cell A24 we will write the Excel formula:
"=CONCATENATE(IF(Reactance_L=Reactance_C;"RESONANCE";
IF(Reactance_L>Reactance_C;"INDUCTIVE";"CAPACITIVE"));" ";"REGIME")''.

In the previous formula we have used twice the logical function IF taking into account the three types of regime in which the circuit can function, namely, inductive, capacitive and of resonance. Also, we have utilized the function CONCATENATE that operates on a series of characters to write the word "Regime" in the same cell with the result obtained for the type of regime following the application of the logical function IF.

To obtain the charts that render the time dependencies of the voltage, current and instantaneous power, we build the source table in the secondary worksheet of the file. As it can be observed in figure 2, along the column B we generate increasingly the values of the moments in time starting from t=0, and in the columns C, D and F, according to the values in B, we calculate the voltage, u(t), current, i(t) and the momentary power, p(t).

	A	B	C	D	E	F	G	H	I
1–2	Source table for curbs of voltage, current and instantaneous power								
3	n	t [s]	u(t) [V]	i(t) [A]	i(t) [x100A]	p(t) [W]	p(t) [x10W]		
4	0	0,0000	0,00	-0,90	-90,06	0,00	0,00		
5	1	0,0002	7,53	-0,83	-82,82	-6,24	-62,40		
6	2	0,0004	15,04	-0,75	-75,25	-11,32	-113,17		
7	3	0,0006	22,49	-0,67	-67,38	-15,15	-151,50		
8	4	0,0008	29,84	-0,59	-59,24	-17,68	-176,80		

Figure 2. Secondary spreadsheet with the source table for charts

The generation of the time moments in column B is done with the help of a time quantum equal to the 100th part of the period of voltage applied and using the increasing series noted with “n”, with the unit step starting from n=0, from the column A. Thus, in the cell B4 the start value is generated according to the Excel formula “=A4*(1/(Frequency*100)), and the rest of the values up to n=225, corresponding to the line 229, are obtained through the propagation of the formula from B4 along the column B. We have chosen n=225 to visualize the curbs in a time interval equal to 2T+(T/4) measured from t=0, when u=0, where T is the period of voltage u(t), obviously equal to the period of current i(t) and the instantaneous power, p(t).

For the calculation of the values from the columns C, D and F we transpose in Excel the relations [1], [2], [12]. Thus, in the cells C4, D4 and F4 we write the formulas:

- C4: “=Voltage_Max*SIN(2*PI()*Frequency*B4)”;
- D4: “=Current_Max*SIN(2*PI()*Frequency*B4-RADIANS(Phase_angle))”;
- F4: “=C4*D4”.

By propagating the previous formulas along the columns C, D, and F up to the last line of the table, corresponding to n=225, we obtain the values of the voltage, current and instantaneous power according to time. In figure 2 there are rendered the first five values of these measures from the 4th line to the 8th line of the secondary spreadsheet.

For a better visualization of the charts of the three measures according to time within the same diagram, considering that the first point of interest is the way in which the respective measures are phased, we have utilized the values from columns B, C, E and G, where in column E there are the values of the current from the column D multiplied by a factor 100, and in the column G the values of the power from column F multiplied with a factor 10.

The chart that renders the instantaneous power according to time using the entry data from figure 1, overlapped on the voltage and current charts is presented in figure 3.

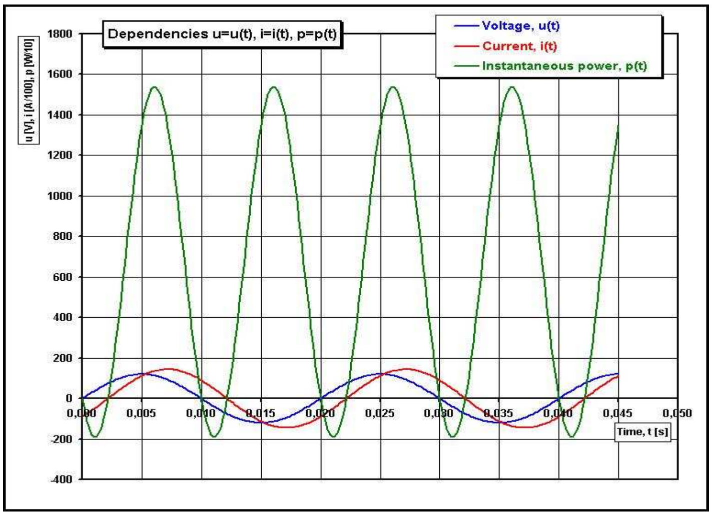

Figure 3. The chart of the instantaneous power according to time

By modifying the entry data we can track the changes in results and in the corresponding diagrams. With the help of the “freeze panel” command, from the menu “Window”, we can bring any of the two diagrams exactly near the table with the entry data so that we can rapidly observe the feedback on the charts when the data are changed.

4. Conclusions

The "Simulation RLC" instrument can be used within an interactive lesson about the electric alternating current, firstly facilitating the acquisition of knowledge regarding the RLC series circuit of alternating current. Through its design, it can be adapted or particularized also for the simulation of other types of circuits. Thus, by correspondingly modifying the calculation formula, we can transform he instrument so that we simulate the RLC parallel circuit, or, in particular, to obtain the simulation of the RL, RC, LC series or parallel of alternating current circuits.

With the help of this instrument, by changing the entry data, different particular cases can be analyzed, immediately obtaining feedback in results and in the associated diagrams. It becomes more efficient in both the teaching and learning of alternating current, and, thus, students can more easily understand this chapter of Physics.

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Computer Programs:

Microsoft Excel 2010.

Getting to Know Physics More by Using Computer Simulations

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Abstract

A higher motivation for the study of physics, as well an increased effectiveness of the educational approaches, requires the using of those strategies that provide students with the opportunity to become familiar with the notions that would allow them to better understand physical phenomena. The transition from the classical approach of physical phenomena that uses extremely simplified models to actually explaining them as they occur in real life can be facilitated by using computer simulations. These simulations take into account a larger number of parameters and illustrate their simultaneous influence on the development of the phenomenon. In this paper, we present the way in which the study of uniform circular motion can be deepened by using computer simulations.

Keywords: Physical phenomena, Computer simulations, Circular motion

1. Introduction

Science today can no longer be reduced to a set of pre-existing scientific knowledge, but is an ongoing process of generating new knowledge. The modern methodology of cultivating the spirit of science in education is nowadays oriented towards associating the logic of learning by doing with the one of learning by discovery. The methods of learning through research underline the value of the students' explanatory ability. Therefore, the student becomes directly involved in exploring a situation, in solving a theoretical or practical problem by discovering the rules that govern it. The practical action mediates the direct confrontation with real situations and creates favorable circumstances for the application and the creative enhancement of the experience acquired. (Cerghit, 2006)

As the learner becomes more and more independent, we enter a new era of learning and training. This requires that the school should have new goals, setting up new cross objectives and also new competences such as learning how to learn and creating new knowledge. These multiplications of the ways in which people get informed and communicate require multiple ways of teaching. (Cucos, 2006)

Once modern teaching has become more student-oriented, creating and developing the student's intellectual capacity to take actions will come before transmitting and acquiring knowledge.

In this way, each individual benefits of personalized teaching methods, according to their own needs and rhythm of learning. Uniformity of training is thus avoided. The student becomes the very subject of teaching. His involvement in the learning process uses his specific intellectual abilities, based on his specific abilities of learning and of approaching reality. The new methods are in favor of developing these capacities, processes and operations. (Cerghit, 2006; Hockicko, 2010)

The active learning is a kind of learning centred on each subject of teaching. It requires them to be intellectually, physically, emotionally and willingly involved in creatively and actively acquiring new knowledge, in forming and developing abilities, capacities, competences and behaviours. This kind of learning is based on an asymmetrical educational relationship where the student regulates the pedagogical approach and the teacher organizes and guides the way the students learns. The purpose is that the student can discover the enjoyment of learning. This will only make him more confident in his own potential and in his desire to know more. (Faust and Paulson, 1998; Bocos, 2013)

The new technologies influence more and more our society. They change the way people work and communicate as well as the way they perceive reality and learn. Thus, all these new technologies create new ways of learning that later influence the way youngsters will be taught and educated. (Cerghit, 2006)

A virtual education means using computers in order to replace the old learning experiences. These are no longer offered by a direct contact with the teacher. A computer can also help students study phenomena that haven't been available before because of their lack of accessibility or high costs. The virtual education allows the student to acquire knowledge by himself, by exploring a world whose limits are set by him. Also, the student can exchange pieces of information with others because he learns within a virtual community. What is specific to this virtual education is the fact that it is focused on learning, not on teaching, and it also involves the student's whole personality in the process. More than that, it is the teacher who will determine the student to be more responsible and look for new information to learn by himself. (Cucos, 2006)

New multimedia systems have appeared as a result of the progress in technology and therefore students are presented their subjects in new attractive forms that can only stimulate their active involvement in the learning process. The huge advantage of these new systems is that they require the simultaneous or alternate involvement of multiple senses in the learning process, thus increasing the amount of information that can be memorized at a greater speed. (Cerghit, 2006)

In modern pedagogy, using the computer in ensuring learning has become essential. The computer allows students to acquire a coherent system of accurate representations that are the foundation of an objective knowledge. The e-learning makes the student become more involved in the process and also helps him in making his own discoveries. More than that, it allows the educational act to become more personalized, as it values the students' individual choices, giving them the freedom of choice as far as what they learn is concerned and making them enjoy doing it. Thus, the student becomes a producer of resources (software, websites, debates in e-groups), resources that can be changed and enriched for later using. (Schauer et al, 2009; Bocos, 2013)

In this paper, we will present the way in which computer simulations, combined with other applied strategies can, in both formal and informal contexts, contribute to the better knowledge of some Physics topics, particularly of those related to physical quantities that are characteristic to the uniform circular motion

2. Combined strategies used to develop students' reasoning in Physics

Developing students' reasoning in Physics can be done through a series of successive processes of abstractions, based on previous observations and experiments. The moment either the teacher or the student make an observation, they interpret what they observe making use of they already know. It is necessary that the teacher should know what knowledge, representations and models the student possesses before approaching a topic or starting teaching a new chapter. More than that, the modern didactic requires that the teacher is supposed to offer the student just a little amount of information, only the essentials, as the student is the one to make the connections. To achieve this, students must learn in complex situations, close to the real ones, making a statement about a concept or about a notion being the starting point for learning. (Ciascai, 2001)

The model is a representation and a simplified explanation of reality. It replicates a complex original model, whether totally or partially, on a different level and in a different shape. This model has a heuristic function due to the research effort made by the students and to the theoretical investigation made in order to discover some truths. However, unjustified simplifications lead to an incorrect perception and understanding of the phenomena studied. The purpose of it is to help students easily switch from a global image of a real fact to abstract representations and the other way around. Modelling through simulation replicates processes, actions or behaviours. The ideal simulator is the product of imagination, being actually a creation itself. (Cerghit, 2006)

Modern teaching considers modelling more than a didactic method. It is seen as an effective way to achieve a modern education, both active and heuristic, where students become accustomed to scientific research. Learning through models consists of an indirect investigation of reality, objects and original phenomena, by means of some model systems. These must be used just when real systems cannot be studied directly. They must be used rationally, according to some clear operational objectives and the proper teaching strategies, as well as to the students' age and psychological characteristics. (Bocos, 2013)

Simulation is a teaching method through which we attempt at replicating a real phenomenon or process. Despite all the changes made, students still interact with the instruction program which is similar to interacting with a real system. This simulation helps the student to create a mental model of the real process and thus being able to test how the system works in different circumstances. It is this way that students learn how to operate with real systems and processes. Activities of computer simulation have a series of advantages: increasing motivation, effective learning, controlling of variables, dynamic presentations and better time management. (Adascalitei, 2007)

A genuine learning also requires approaches complementary to the formal ones, made in non-formal contexts and oriented by objectives well set by the teacher. Such a teaching approach can be made also by using the advantages offered by computers and the students' imaginative abilities. A genuine learning challenges students to make a move, to explore, to research and to create in curricular environments exterior to their school. Furthermore, it encourages them to solve problems that are both relevant and attractive, with an integrated character, specific to the natural environment. (Bocos, 2013)

Switching from the traditional teaching paradigm illustrated by traditional learning to the modern one cannot be achieved by one method or strategy but requires the combination of several teaching strategies. Learning through this combination of methods actually means the combination between the real and the virtual learning environment. Thus, learning becomes more effective than just using traditional lessons and online ones separately. Furthermore, learning through combining teaching strategies brings fundamental changes in the educational activity, especially as far as the roles of the educational actors, teacher and students, are concerned. (Graham, 2006)

3. Studying the uniform circular motion by combining learning strategies

Uniform circular motion is one of the themes that is optional in the ninth grade Physics curriculum.

With very little time to address this topic, which will still be the basis for further study of other important topics in Physics (such as the balance of the bodies, oscillations, atomic models), the teacher needs to organize this teaching approach by combining with maximum efficiency a number of methods that should give students a good knowledge of the basic concepts, as well as make them able to transfer these in different situations. In order to achieve all the objectives set for the study of the uniform circular motion, a series of activities had to be done while using different teaching strategies.

In order to recognize and identify the main features of uniform circular motion, during our first class on the topic, students were asked to describe a real-life situation where the uniform circular motion can be identified. The required description, made with a text editor, was not supposed to exceed one A4 page of a document that was later going to be part of the student's portfolio, as one of the components to be analyzed in order to evaluate the progress made in this chapter.

It was found that this approach was a true brainstorming, students identifying a variety of situations in which this type of motion is the basis of a phenomenon or of the operation of a device (moving clockwise, orbital movement of planets around the Sun, the planetary model atom, carousel, potter's wheel, moving along the serpentine etc).

Organizing a trip that included a visit to a pottery centre had, besides recreational purposes, also a research goal, the students being asked to identify situations where the uniform circular motion was involved and to describe the evolution of its characteristic parameters (speed , acceleration, centripetal force). The observations made in this non-formal learning environment were to be used to present a case analysis in a PowerPoint. In this way students could apply the concepts learned to solve problems drawn from real life. (Figure 1)

Figure 1. The visit to a pottery centre

In view of a rigorous analysis of this type of movement and deepening newly learned concepts students were suggested to conduct virtual experiments. In order to simulate movement, they could choose any of the online simulators indicated by the teacher in the Resources section of the web site wiki that was used to support their study of Physics. These experiments were carried out by individual students, and they had the task of making screenshots for each step of the experiment. These screen shots were to be placed in the personal portfolio. (Figures 2 and 3)

It was found later that the students learned more effectively the Physics concepts studied as the simulators offered them the possibility of having a graphical representation of the evolution and interdependence of these Physical quantities.

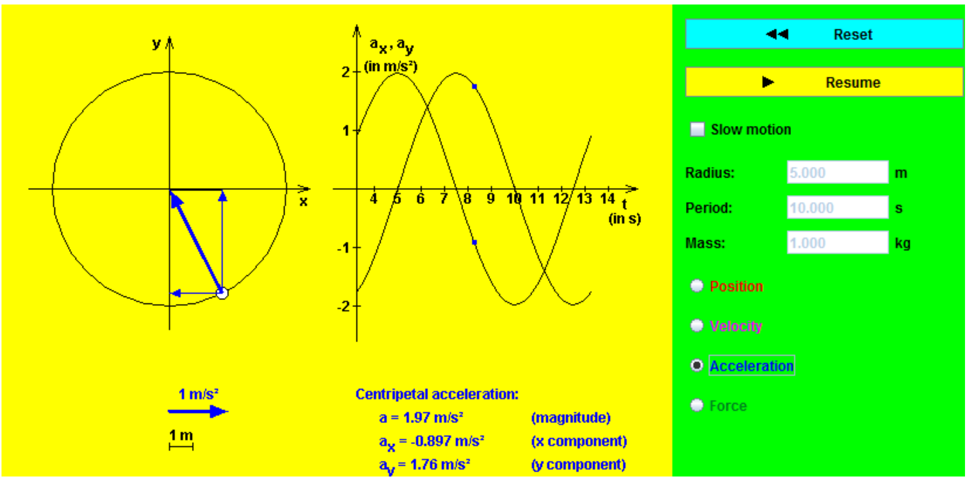

Figure 2. The study of uniform circular motion with simulation from http://www.walter-fendt.de

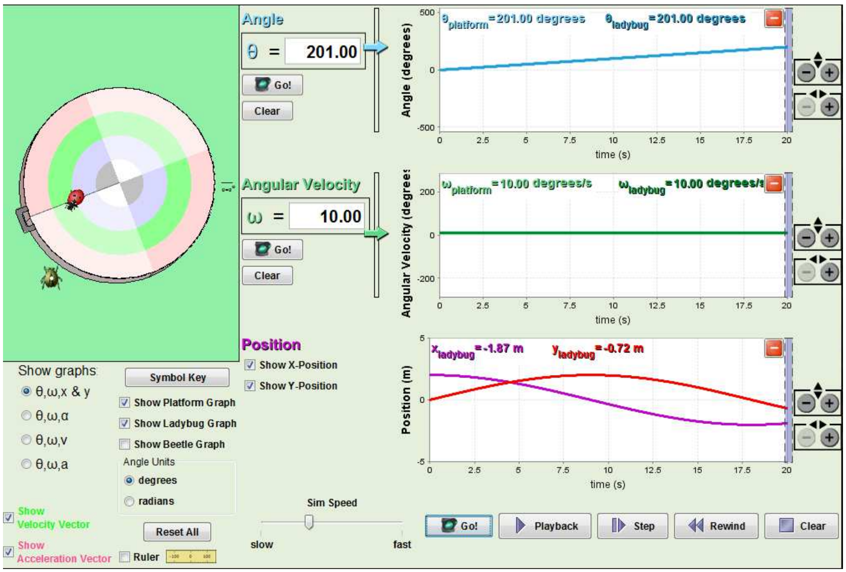

Figure 3. Figure 2 The study of uniform circular motion with simulation from http://phet.colorado.edu

The follow-up was done by creating a personalized and creative Power Point presentation that was meant to explain one of the situations identified during the thematic trips, explanation which had to have the character of a scientific micro research. It is true that not all students were able to make products of a high scientific rigor, but each of them made approaches according to their level of preparation, seriousness, cognitive ability and personal creativity to some extent. After checking these items, the teacher made a selection of the most relevant products and posted them on the wiki in the Applications section, in order to present and discuss them during a designated class. (Figure 4)

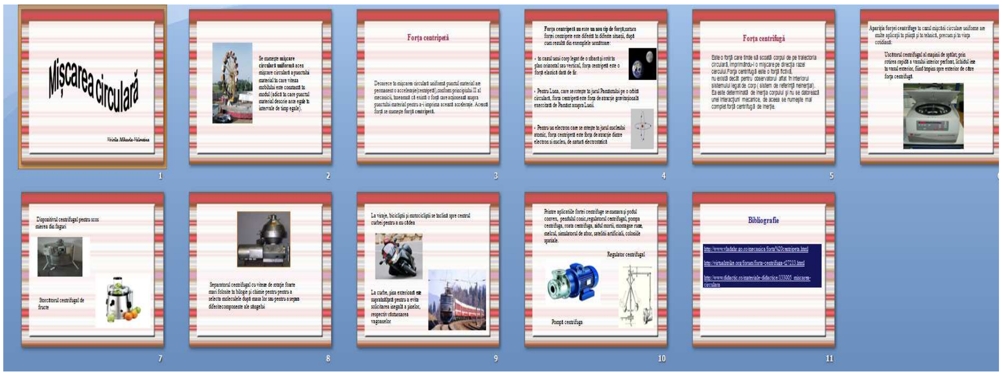

Figure 4. A student's presentation about uniform circular motion

The assessment of knowledge acquired by students through the study of uniform circular motion was made by writing an essay on "uniform circular motion in everyday life." Clear criteria for writing it (content and wording) allowed an objective assessment of the degree to which concepts have been properly studied and learned thoroughly.

Both theoretical and digital resources provided by the teacher to study uniform circular motion, and the most representative products of the students, in terms of product quality and scientific rigor of the presented information are available on the website www.fizicamd2012. wikispaces.com. (Figure 5).

Figure 5. The wiki used for better understand the uniform circular motion

4. Conclusions

Students' digital products can be considered an electronic version of the KWL chart. If documents originally developed by students fit in the sections "I know", "I want to know", their final presentations will belong to the section "I learned." Thus, the combination of instructional strategies reflects the student's route in learning and deepening the Physical concepts studied.

Although the theoretical concepts presented by the teacher and demonstrative experiments were conducted in the period stipulated in the planning calendar (two classes allocated), uniform circular motion study was carried out throughout a much longer period that included the trip, the experimental study of uniform circular motion using computer simulation, the realization and evaluation of students' synthetic presentations and the assessment of their products. Assigning a much longer time to prepare a theme that uses active-participative methods or restricting the content to be addressed in a given time is actually the main downfalls here. (Faust and Paulson, 1998)

This combination of the formal with informal learning reduced the tensions that usually arise during the study, when we have a longer series of topics. Thus fatigue was replaced by leisure time during the thematic trip, while monotony was replaced by the curiosity for conducting virtual experiments to investigate real-life situations, chosen by the student. The active methods used, as well as the support provided by the e-learning allow the teacher to achieve the objectives on both the cognitive as well as affective and psychomotor levels. Furthermore, the expression of creativity is encouraged in pupils.

Active and participative methods require teachers to create situations that allow students to use a variety of processes and mental operations, to promote the initiative and spontaneity. Thus, teaching each subject should be seen as a way to stimulate and develop intellectual capacities and processes as well as those operations that generate them. (Cerghit, 2006)

It is well known that the student is more motivated to learn when the teacher integrates a computer program in his teaching. (Hockicko, 2010) The use the computer and of all new technologies do not provide, however, self-training education but contribute to students' learning experiences that facilitate knowledge construction. It is important that they should be articulated in the curriculum design process and also should facilitate obtaining specific learning outcomes. (Bocos, 2013)

Among all participants in the educational process, the teacher is the one whose involvement is most required. . Even if he is no longer just a transmitter of information, which is vast and continuously growing, the teacher's role as facilitator and organizer of learning is more complex, requiring the involvement of a much larger volume of intellectual resources and time, as well as and a permanent update. However, the students' results in training, developing their capacities and competences, their changing into new sources of knowledge fully compensate this effort.

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Using new technology in kindergarten activities – a real necessity?

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Abstract

New technologies exercise a direct influence on the transmission of information as well as on social skills formation in school. The existence of these technologies in the child's life, but also in the educational environment has generated and still generates constant change, on the one hand, in terms of life experience and, on the other hand, in pedagogical area, as a resource, means, interactive teaching strategy.This study is an investigation into the place and role of the computer in teaching activities is kindergarten. The population investigated, consisting of pre-school teachers, members of the Association of Educators in Romania, presented interest in terms of how they perceive and use into their own activity modern means, considering that the sample had a heterogeneous structure. Thus the subjects were positioned according to criteria such as: level of education, teaching experience, the level of continuous training, area of origin, which enabled the collection of data relevant to the subject. Assuming that the computer facilitates the work of the teacher, we found different degrees of involvement of the various types of modern activities with preschoolers - mandatory optional and complementary activities - which shows that the place and role of new technologies are determined by a number of factors related to: teacher's competence and creativity in sketching the design of activities, levels and training needs of preschoolers, material resources and the allocated time.

Keywords: Instruction **:** new technologies, kindergarten, computer, activities with preschoolers.

1 The context of research

Technologies play an increasingly important role in our society, reaching daily use to determine the relationship of the individual with the world. The Extraordinary Social spreading of Informatics allows us to examine its implications in an important dimension of human activity: education. The problem of using and integrating new technologies in education is an aspect that has been concerning all actors of the educational area lately.

The preschool period is of great importance in the acquisition of knowledge and skills necessary for the future student, kindergarten helping each child to become independent, to think critically, to acquire a rich, organized and understandable spoken language. In kindergarten, ICT is not a new disciplinary field and does not replace fundamentally practical activities but it represents a means of production, communication, documentation, discovery, experimentation, simulation and practice. Integrating new technologies in kindergarten is a challenge the teaching approach aiming at the suitability of performant modern techniques to the age level of the child, to the teaching-learning objectives of preschool education (Gioux 2009). Finding effective solutions using new technologies as tools, through which to obtain first knowledge acquisition and skills training specific to kindergarten, is an actual problem.

The new technologies that can be used in kindergartens can be classified as:

- the Internet and online services: forums, blogs, electronic dictionaries, search engines, videos on youtube;

- independent resources : USB sticks, podcasts;
- software : maps, 3D images, animated tutorials, simulations, games,
- projection or recording devices: computer / laptop, tablet, i-pad, i-phone, e-books, webcam, projector, digital camera.

The added value and benefits of using these new technologies can be identified at several levels:

- at children's level:
  - facilitates learning by using other forms of presentation, mainly visual information;
  - increases the child's motivation and valorizes his work;
  - favors student's autonomy;
  - fosters constructive discussions between children after completion of activities;
  - causes the child to interactto engage actively;
  - develops his critical thinking;
  - contributes to the organization of information in the child's mind;
  - allows acquisition of experimental data.
- at teachers' level:
  - contributes to a better dispensing teaching of time;
  - fosters the teaching feedback, due to immediate ackowledge of children's acquisition;
  - facilitates the exchange of information between teachers after activities;
  - contributes to a better rationalization of the work due to the development of technological skills.
- at the preschool level and the teacher:
  - represents a modern way of evaluation and self-evaluation;
  - provides the possibility to access continuously various and up to date resources;
  - allows carrying out activities together;
  - gives the possibility to make enjoyable some boring scenes of the activity;
  - constantly allows updating resources;
  - promotes continuity between the activities developed in kindergarten and the work done after completing the activities.
- at the level of the relationship between the teacher and children:
  - fosters interactivity within the group;
  - enables communication and sharing of information outside of activities carried out in kindergarten (weekends, holidays);
  - provides individualization of teaching and learning.

In this study we assumed that the new technologies and their integration into kindergarten activities involve reporting to a system of needs (Assude, Loisy 2008): epistemological (related to subjects' nature), educational (related to organization of the classroom activities, to the relations between teacher and children and to children's autonomy) and didactical (about proper organization of the child's educational process). Thus, we try to answer the question: do the new technologies constitute effective teaching tools for teaching in kindergarten?

2. Objectives and research methodology

2.1 Study Objectives

So we took into consideration teacher's practical and professional experience, and the characteristics of the new resources represented by the modern means that can be exploited in the preschool.

In our undertaken research we have focused on the following objectives:

- highlighting the usefulness of the computer in group work;
- highlighting the involvement of the various types of modern activities with preschoolers;
- highlighting how preschool teachers resort to modern means.

2.2 Research Methodology

In order to obtain information necessary for carrying out this study a questionnaire was developed that was distributed to a group of 70 primary school teachers, members of the Association of Educators in Romania. Out of the 70 questionnaires 63 have been validated, the errors are due mainly to blank fields or incorrectly filled.

3. Structure of The Sample

The investigated population, consisting of 70 pre-school teachers, presented interest in terms of how it perceives and uses for its own modern means, given that the sample had a heterogeneous structure. Thus the subjects were positioned according to criteria such as level of education, teaching experience, level of continuous training, background, which enabled the collection of relevant data for the subject suggested. It is also mentioned that the investigated sample include subjects from several counties.

3.1 Age distribution

Type In terms of age, the highest percentage is owned by the category of persons aged 30-40 years, the percentage is 40%. The other age groups - 19-30 years, 40-50 years, 50 years - have almost equal shares, representing 19%, 19% and 22% of the sample.

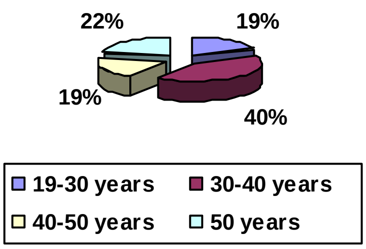

Figure 1. The age distribution of subjects

The age variable is particularly important because the subjects belong to different periods of initial training, when modern means were more or less present. Thus, it is useful to note the influence of this variable in the choice of the means in the preparation, organization and conduct of the group, trying to see if new technologies are most frequently accessed by young academics or are present at all ages.

3.2 Distribution by level of study

Among the 63 teachers interviewed, four are pedagogical high school graduates, four post-secondary school graduates and 55 university graduates. Among university graduates, of which 5 have Masters studies, 32 have graduated the specialization Pedagogy of Primary and Preschool Education, which showed that the introduction in the university curricula of the courses of Information and Communication Technologies (ICT) and Computer Assisted instruction (CAI) has created an effective solution to form skills for using and also for didactical integration of computers in education.

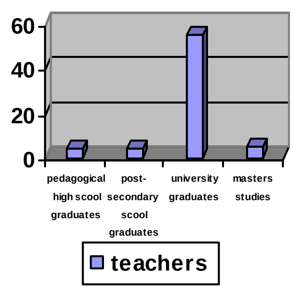

Figure 2. Distribution by level of study

3.3 The institution which they work

a. The environment. Of the 63 teachers interviewed, 42 are active in urban areas, representing 67% of all respondents.

The good material endowment available to kindergartens in urban areas, but also to a large part of those in rural areas, constitutes a favorable opportunity to use new technologies in good condition.

b. Type of kindergarten. The surveyed teachers originate relatively equally both from kindergarten with regular schedule (34) and also from kindergartens with extended schedule (29).

This aspect is relevant for the present research as the time spent in kindergarten with regular schedule is different in terms of quantity from the time spent in kindergartens with extended program, offering more opportunities for exploiting new technologies, given a wider range of activities possible.

c. The group type . The sample consists of 30 subjects that develop their activity in simple groups and 33 teachers from combined groups. the remarkable homogeneity of the sample can be also observed in this aspect. The combined groups activity is characterized by a certain specific, involving a higher degree of difficulty both in organizing and in choosing teaching strategies.

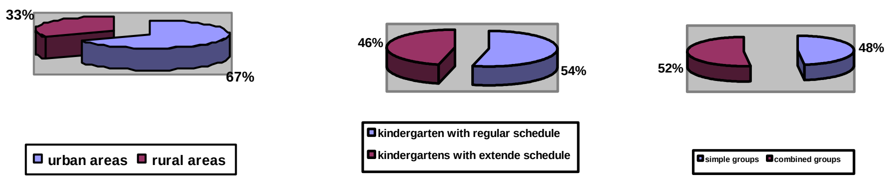

Figure 3. The institution which they work

3.4 The existence of a personal computer and an internet connection.

62 of the 63 subjects interviewed have a personal computer connected to the Internet, an aspect that gives them the chance to diversify the sources of information, the ability to use the computer to prepare teaching materials, but also the opportunity to perfect their digital skills.

4. Data analysis and interpretation

Figures should when questioned over the types of teaching aids used in preschool, subjects indicated that they use in their activity both traditional and modern resources. Due to technological development and expansion of new technologies in education, modern means are gaining more ground in classrooms, with the advantage of high degree of attractiveness exerted on children.

Item 2, shows which are the modern resources the most used in teaching. Thus, the most options are moving towards computer, projector, CD player, DVD player, educational software, online resources. The data analysis found that 56 of the subjects use the computer, 37 subjects use the projector, 20 the CD player, 17 the DVD player, 50 educational software and 32 online resources. From the information gathered we draw the conclusion that kindergartens equipment is reflected in designating the computer as the primary modern means used in teaching. This modern means is characterized by complexity because it offers many possibilities for exploitation. In schools, Internet access for teaching still constitutes an issue generated either by the impossibility of connecting in rural areas difficult to access, or by the lack of financial resources. This drawback is prevented by the use of a considerable number of different kinds of educational software.

Item 3 investigates the purposes on the use of computers. It is found that 56 of respondents use computer in educational activities, 49 of them use it in creating teaching materials needed, 56 for individual study and 10 for other purposeslike: communication, recreation, socializing, shopping, etc.. From the responses provided it appears that most teachers use new technologies for work, these constituting a necessity in teachers' life.

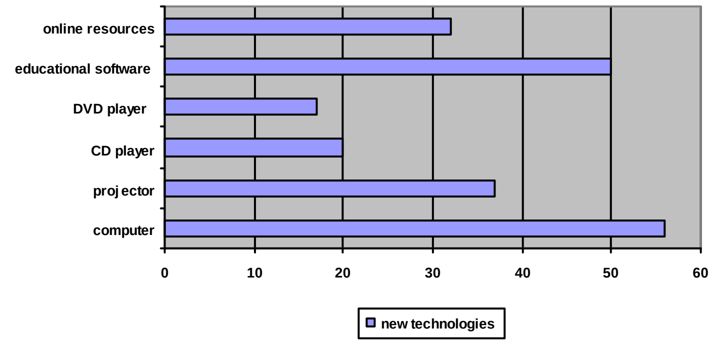

Figure 4. The modern resources the most used in teaching

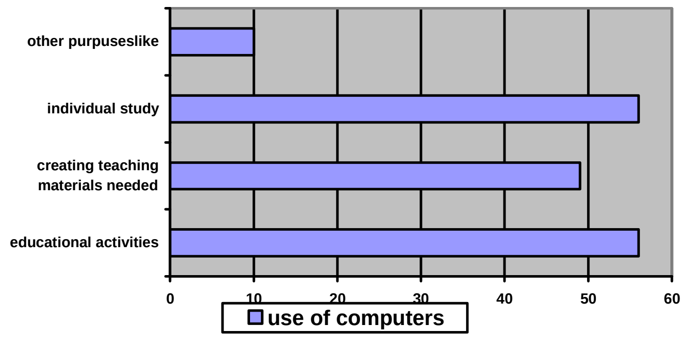

Figure 5. The purposes on the use of computers

Item 4 shows the frequency of computer usage in teaching preschoolers by the 56 subjects. Most of the subjects (23) use the computer 2-3 times a week at various times of teaching, 14 of them weekly, 12 daily, and 7 occasionally. These data lead to the conclusion that the computer is a constant presence in establishing didactic strategies of preschool activities proving its utility. Also by reporting these results to age indicator, we found a uniform distribution of the use of new technologies in all four age groups discussed. This indicates the presence of technological skills at any age, skills derived from necessity and usefulness of these tools in the field of preschool education.

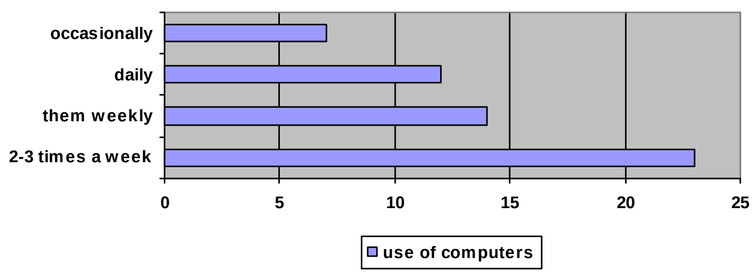

Figure 6. The frequency of computer usage in teaching preschoolers

The activity in kindergartens involves a specific progress consisting of freely chosen activities (FCA), activities in experiential areas (AEA), personal development activities (PDA) and transitions. Computer using in AEA by 50 subjects demonstrates the importance of new technologies in structuring teaching process. 40 teachers claimed that they use computer in freely chosen activities, 26 in personal development activities and 24 in transitions. The need to use the computer as a means of teaching is given by the multiple opportunities to use it, since in activities with preschoolers, media tools should be characterized by concreteness, clarity, visual support. Children's learning is facilitated by the use of new technologies, helping them to a better understanding of the visual representation of knowledge and an easier assimilation.

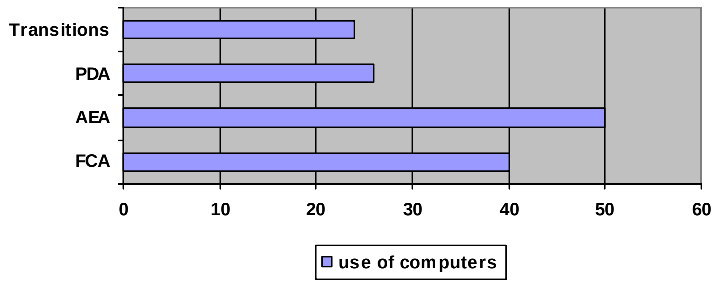

Figure 7. The use of computers in the activity in kindergartens

In carrying on activities in areas, new technologies are an alternative to traditional means, some of them replacing them with success. The diversity of educational software allows better interactivity developing children's skills needed in modern society. Through their interactivity, modern means determine the child to want to engage in activities in kindergarten and outside it. New technologies foster learning because the child becomes an active participant in his own training using modern devices himself and also because he creates, designs and develops content.

5. Conclusions

The International Assuming that the computer facilitates the work of the teacher, we found different degrees of involvement of the various types of modern means in activities carried out with preschoolers - mandatory, optional and complementary activities - which shows that the place and role of new technologies are determined by a number factors related to: teacher's competence and creativity in designing the activity; the level and training needs of preschoolers;, material resources and time allocated.

Quoting Umberto Eco, that "every time we invent a new technique to transmit knowledge, we fear that it will kill the previous ones", we find that, in practice, new technologies cause some reluctance into the educational environment. However, with the reference of human history, in which new discoveries like printing, photography, cinema, have not canceled and replaced old cultural values as religion, painting, theater, we can assert that, within the school, modern means have their well established ranks, without eliminating traditional means.

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Skills training methods of computer use among primary school teachers

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Abstract

The access to new technologies requires specific skills determined by a complex process of professionalization, during which teachers acquire knowledge, develop their skills and abilities formed under the pressure of multiple transformations of the information society. Among these skills, the ability to use the computer requires on one hand, technical skills of operation and, on the other hand, critical thinking enabling the identification and selection of online qualitative and useful resources necessary to teaching. This means reading and understanding the information, content differentiation, the creation of a corpus of resources adequate to the intended purpose. In this study, we performed an analysis of computer use skills training methods among primary school teachers, based on the idea that these basic technical skills are needed to define the personality of the professional in education today. Although it may be considered a useful tool mainly at higher levels of education, computer technology is gaining more and more ground, proving its effectiveness in kindergarten.

Keywords: initial forming, continuous forming, technologic competencies, new technologies, pre-school education

1. Introduction

Information and communication technology represents one of the most significant factors of the contemporary society. Neither the education field remains outside the expansion of new technologies, on a global level being made substantial investments in this direction in order to increase efficiency and effectiveness of the education systems.

Nowadays, creating the digital competencies takes part of the initial training of the teachers in most of the European countries, these developing strategies which encourage the use of the new technologies in education (EURYDICE, 2011).

Appealing to new technologies in education is a factor which needs respecting some conditions such as: training programs adapted to teachers' needs, computer skills, the actual degree to which teachers and students have access to computer both at school and home and time allotted for the actual use of computer laboratories.

Baron and Bruillard (1996) distinguish the different purposes if using the computer: playing, learning, work and they state that in the learning process the computer can play three roles:

- the first role, of partial substitute of the teacher by making the transition from one teaching activity conducted by the teacher to computer assisted training;
- the second role, of means of expression and exploration by promoting the activity and initiative of the ones who learn in an unlimited learning environment;
- the third role, of intellectual work tool and elaboration of intellectual products, which can be integrated in educational tasks.

The new technologies involve five stages of their adoption as a constituent of the teaching strategy (Hooper and Rieber, apud Otero et al., 2005):

- The familiarity (initiation by observing without the proper use);
- The use (there are used new technologies in the classroom but without them being considered specific pedagogical tools);
- Integration (new technologies are part of the teaching strategies);
- Reorientation (new technologies become more than simple teaching means, contributing to a new structure of the teaching activity);

Evolution (activity structure and the used strategies are permanently changing).

2. Types of technical skills training

The education specialists consider that using new technologies in teaching activity is effective if the teachers have received a good training in this field. Thus, it is necessary that the teacher to be aware of the new technological breakthroughs, to know what can be successfully used within the educational process, to adapt the electronic resources to the age level of the children and to their learning needs.

If we refer to different types of training, the most used classification in literature is: initial training – continuous training. As far as ECT and CAI training is concerned, some studies put forward the idea of the existence of another dichotomy: formal training/informal training. Granger et al. (2002) undertook a research over Canadian education and they reached the conclusion that the interrogated subjects prefer informal learning (internet search, reading some material, socialization, discussions and collaborating with colleagues, children and parents), feeling that this is the most favorable for information transfers, provided that it facilitates a practical, immediate learning.

Other researchers (Cleary, C. et al., 2008) have tried to highlight five aspects which condition the iniatial and continuous training by giving them certain specificity. These requirements contribute to a more efficient integration of new technologies:

Training demands	Demands related to material resources	Individual demands	Institutional demands	Time demands
- the ability of the teachers to use the computer ; -the characteristics of the subject taught; -the age level of the students trained by the teachers.	- access to the ICT equipments; - number of computers and other existent ICT equipments; - ways of implementing the new technologies (informatics laboratories, laboratories for other subjects, phonics rooms, classrooms); - the liability of the technologies; - the internet access; - connecting the computers to a network;	- a positive and open attitude towards the usefulness of the new technologies; -the confidence in their own abilities to assimilate the new technical innovations; -the professional experience.	- supporting the school organization that the teacher is part of, both from the technical point of view and also from the pedagogical or scientific point of view (by the colleagues, students, technicians, ICT coordinators, administrative staff); -type of leadership; -the dynamic culture of the educational	-the availability of time resources.

	- the quantity and the quality educational software programs; - the easiness of using the educational software programs.		organization characterized by a dissemination of good practices (the inclusion of debutant teachers); - the desire to participate in the social general evolution.	

Table 1: The demands of the initial and continuous training with the objective of integrating the new technologies within the teaching process.

The integration of the ICT in the education system is related to three important elements:
- the initial and continuous training of the teachers;
- the attitude of the teachers towards the ICT;
- the conditions or the context of the actual ICT.

Regarding the training, there is a variety of training types, of great importance being the targeted and practical training type. For example, for the initial training, the future teachers need models of good practice and also a certain pathway after following the formal training.

The attitude of the teachers towards the new technologies is reflected in the necessity to own technological skills that they are showing, and this represents a permanent challenge for the training in this field.

The context of ICT integration calls for the availability, the accessibility and the liability of the materials and of the software programs. It is necessary, therefore, to form a community that can point out the challenges at the level of technology but also at the pedagogical level, especially by forming and involving some coordinators who can disseminate the information.

Gentil and Verdon (2003) present the following possibilities for training teachers in the above mentioned field:

– self-learning;
– extra-professional contacts;
– professional contacts (training with the help of the colleagues);
– initial learning course (professional or not);
– continuous learning courses.

Regarding the use of the new technologies in the classroom, the same authors have emphasized the fact that the teachers who have been through at least three of the training paths mentioned above, are more skilled in this field that their colleagues.

3. Specific skills using of the new technologies

According to the national training standards for the teacher position, the technical and technological skills are considered methodical type skills necessary for the teacher to teach, develop and improve the study and self-control practices to the students. Among the professional skills viewed within the training of the teachers, we identify also the technological skills of using the ICT in the teaching-educational process that translate to:
- practicing a reasoning attitude and an outlook view by relating to the advantages and the disadvantages of ICT;
- communicating with the aid of multimedia tools;
- using the ICT for researching, interpreting and communicating the information and for resolving the problems;
- using the ICT for constituting networks for information exchange and continuous learning;

- helping the students to learn the ICT, to use the new technologies for study, self-assessment and for making a critical analysis of the gathered information.

The future teachers must learn the ICT, both for planning and also for managing the teaching-educational process. Therefore, the teacher who received training in this field must be able to communicate through the new technologies, to teach with the aid of the ICT, to plan his activities using these modern means. Plus, the teacher must be able to stimulate the children to assimilate the new technologies in order to study. It is equally indicated that the ICT participates in the professional development of the teachers, in their continuous learning process, considering the new technologies as an instrument they can use for learning.

4. Using the new technologies in the activity of the teachers from the preschool education system

The matter of training the teachers from the preschool education system with regards to the use of the new technologies within the teaching process represents a discussion matter required both by the educational practice and also by the multiple transformations that the nowadays society is going through. The more aware the teachers from the preschool education system are of the multiple usage of the existent educational software programs, the more they will have the opportunity to make their professional activity better and more efficient through: organizing and performing activities within the class, drafting the necessary material for performing this activities, creating educational software programs, using the internet as an information and documenting source, consulting the virtual libraries, communicating with other similar institutions, with the Inspector´s Office, with the Teaching Body Office, with the Ministry, drafting the timetable and monitoring the children.

Using the new technologies in the kindergarten teaching activities causes an impact on the teacher, on the preschool child and also on the process.

THE NEW TECHNOLOGIES are influencing as follows:		
THE TEACHER	THE PRESCHOOL CHILD	THE TEACHNG PROCESS
- facilitate the teaching activity; - stimulate innovation and make the teaching performance more modern; - allow a better management and use of the teacher´s time.	-facilitate the understanding of the phenomenon; - develop the skills of working with the computer; - challenge and develop the interest for activity; - allows the gaining of knowledge in a personalized and own pace; - favors autonomy; - increases motivation; - enables to enhance the value of the child.	- contributes to a better rationing of the activity; - develops team work skills; - favors the active and interactive participation; - allows a more rapid feed-back; - increases the attractiveness of the process.

Table 2: The influence of the new technologies in the preschool education system

The pre-school teacher has the freedom to innovate the teaching strategies, showing its creativity by integrating new technologies in the teaching activity. The diversity of the new technologies may be suggested by some examples of their use at kindergarten:

- discovering letters and figures on the keyboard;
- drawing, coloring through some specialized software having also the additional possibility to integrate in activity other devices such as the printer or camera;
- electronic correspondence with other kindergartens, the teachers being the one who accesses the received messages and drafts the children’s answers;

- a great diversity of electronic and handy kept images: photos regarding some experiences and activities, posters, images of the environment, children drawings a way of knowing the world.

5. Conclusions

Although it may be considered a useful mean, mainly at higher levels of education, informatics technology gains more and more ground, proving its efficiency at kindergarten also. The pedagogical integration of ICT in the school context requires a broad range of skills and it is important that all the actors involved in teachers training to work together so that they support the future teachers in pedagogical integration of the new technologies. Being under the pressure of social changes, modern school questions not so much the introduction of new technologies in the teaching approach, as their judiciously use in order to achieve educational outcomes. Thus, it seems very important to enroll computer assisted training in the professional training priorities of the teachers involved in different levels of education.

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Analysis of the ICT impact on students, teachers and school practices

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Abstract

This paper systematizes the impact of the Information and Communication Technology (ICT) in school education. The analysis is taking into account the results of ICT studies developed by international organizations (European Union, European Commission, OECD), case studies developed in schools (ImpaCT2, PILOT) and studies developed at regional level (NORDIC 2006). The results can be considered arguments to sustain and promote ICT initiatives at school, regional and national level. Moreover, they can be a point of reflection for the ICT skeptics and a starting point for discussions focusing on how school should start its trip toward the innovation.

Keywords: ICT impact, technology integration, school education

1. Introduction

One of the most important questions of researchers interested in integrating technology in school is related to its real impact in education. During the last three decades, there have been developed studies that aimed to identify the effects of technology use in education. In the late 80's, these studies wore focusing more on the Information and Communication Technology's (ICT's) impact in mathematics and science (OECD, 1986, OECD, 1987). A decade later, the increased interest on integrating ICT in education led to an increased investment in developing the school infrastructure and the teacher training programs. Nowadays, ICT in education is considered a strategic priority. The area of the ICT studies diversified, including new tools and applications. However, despite the investments in ICT infrastructure, students still use ICT more at home, than at school (OECD, 2011).

2. Why integrating ICT in education?

The rapid development of the technology, the occurrence of broadband internet and the distinctive way we access information require new skills and competences. For students, this means acquiring those skills and abilities that help them search, select and reorganize the information in order to build their knowledge. For teachers, ICT introduction in schools brought a double challenge. Most of those who are teaching were trained before the rapid development of ICT use in education and they have been mostly involved in technological literacy classes. Therefore, the lack of ICT skills is affecting both their ability and willingness to use ICT resources but also the manner in which they perceive ICT use in education (Ramboll Management 2006, p.15, Condie si Munro, 2007, p.17; Fluck şi Dowdent, 2011, p.1). However, due to their daily exposure to ICT at school, the ICT pressure and need to use it in activities, teachers have to identify solutions that allow them to develop ICT skills (Wastiau et al, 2013).

Another factor that played a significant role in the ICT integration in education is represented by the students. Students are exposed to a higher amount of information than the previous generations. The researches have systematized the following concepts which describe the specific characteristics of the students: **digital natives** (Prensky, 2001), **Homo Zappiens** (Tapscott, 1998 cited in Veen, 2007, p.2) **Net Generation** (students born after 1980 Obliger and Oblinger, 2005), **Generation Games** (Carstens and Beck, 2005), **New Millennium Learner** (OECD, 2008).

What do these students have in common? They are always connected to ICT. They like multitasking, they are more focused towards the results and performance, they are fascinated by the technology, like to be involved in group activities, learn through discovery, have very good spatial and visual skills, they are not afraid of failure and like taking risks, but also they are very sociable, creative, and they are very fast in online communication and learn a lot by playing (Howe și Strauss apud Oblinger și Oblinger, 2005, pp. 2.4.-.2.5., Veen, 2007, pp. 2-3, OECD, 2008, pp.8-9, Carstens și Beck, 2005, pp.22-25, Lam și Ritzen, 2008 apud Redecker et al., 2009, pp.23-24, Redecker, 2009, pp.15-17).

Having the knowledge of these characteristics is particularly useful because it allows teachers to adapt the educational activities, by developing individualized learning paths (Istance and Kools, 2013). The presence of digital natives in the classroom can be a challenge and, in the same time, an advantage. Thus, since teachers benefit from students knowledge and skills, mainly when students can show to the teacher new ways to use technology and solve various equipment problems encountered by the teachers (Ertmer et al. 2012, p.434).

3. ICT impact on students

Researches indicate that the introduction of technology in education has a positive impact on the manner in which students learn, being associated with an increase in students motivation, their involvement in solving school tasks, but also with an improvement in their school performance, learning efficiency and PISA assessments results (OECD, 2004, p.52; Machin, 2006, p.2; Ramboll Management, 2006, p.28-51; Skinner apud Machin, 2006, p.1; Erstad, 2009, pp.25-27; Ala-Mutka et al., 2009, Vuorikori et al., 2011a, p.11).

Moreover, other studies indicate that ICT use in education improves students performance in English and science, supports the development of students' research skills, increases the time devoted to reflection and allows obtaining a quick feedback from teachers (Harrison et al, 2002, p.16; Higgins , 2005, p.10).

Furthermore, ICT integration help students to understand what they learn, improve their performance in mathematics, science and foreign languages, increase their results at national assessments and improve their reading and writing skills (Higgins, 2005, pp.10-14; Underwood, 2005, pp.26-30; BECTA, 2006, p.44; Machin, 2006, p.5; Pedersen et al, 2006, pp.26-64; Blamire, 2009, p.204).

However, obtaining these results requires changing the teaching methodology. But, although teachers' recognize that ICT has a positive impact on teaching activities, they believe that their methodology has not changed and should not change (Ramboll Management, 2006, p.27). Parents, students and teachers alike agree that the introduction of technology in education has beneficial effects not only on the manner in which students learn but also how they act. Thus, since ICT use had been associated with an increase in students responsibility towards their own learning, an increase in their self-confidence and a more creative behaviour (Ramboll Management, 2006, pp.15-51). Also, ICT has supported communication and collaboration between students, and between students and teachers, giving students a greater degree of autonomy and adapting teaching to students' learning needs (Vuorikori et al., 2011, p.11, Istance and Kools, 2013).

In addition, the case studies analyzed in IMPACT 2 research indicated that teachers prefer to use ICT due to their positive effects on motivation, communication and on students' training skills

(Comber et al., 2002, pp. 30-36). In 2006, Nordic countries developed an extensive research which involved 8000 students (5th grade, 8th grade, 11th grade), teachers, parents and school principals. The results indicate the existence of a high-impact of ICT on students' motivation, task commitment and creativity. Teachers drew attention to the fact that students were more active when ICT was used during lessons. Students were more encouraged to work in teams, to collaborate, becoming more involved in practical activities. Moreover, they paid more attention in classes, gained more self confidence, and believed that doing homework by using technology was quite fun. In other words, students' attitudes and their involvement in school activities have changed (Pedersen et al, 2006, pp 26-64).

But the use of ICT not only encourages students to become more involved in solving various school tasks, but it helps them to develop creativity and self-directed learning (Johannessen, 2009, p.17). Students are not so much preoccupied in reading books, but are more interested in practicing certain skills (van den Beemt et al., 2010, p 4) and developing multitasking (they can speak on various communication channels and in the same time they can solve the homework).

Identifying and knowing these results is important, especially considering the fact that students learn more about ICT outside school and therefore they develop skills that are not yet measured in school (Ramboll Manageemnt, 2006, p .19). This situation can alarm both the policymakers and practitioners. For the policymakers, this is a proof that there are still measures that need to be taken in order to adapt the school to the fast changes that take place in the society. For teachers, this is an opportunity to valorize students' true potential and to make the required improvements.

A case study developed in a Hungarian school during the STEPS research indicates that constructivist learning environments that use information and communication technologies improve the learning results of students coming from disadvantaged families (Blamire, 2009, p.204). Even Web 2.0 resources, that support and promote communication, socialization and development of learning 2.0., mediate and facilitate the inclusion of children with special educational needs (Redecker et al., 2009, p.12) by improving their access to learning and employment opportunities, and by developing skills and competencies (Redecker et al., 2009, p.107). Moreover, digital games use in education led to the emergence of digital game-based learning. This type of learning is more efficient among students when the games have a very rich learning content and they are very easy to use (Cheng, Lou, Kuo and Shih, 2013).

European Agency, Schoolnet, developed a pilot study through an educational partnership with ACER. Based on the conceptual model of Heo and Kang (2009), this study aimed to identify how teachers and students from 164 schools from six countries (France, Germany, Spain, Italy, Turkey, United Kingdom) use notebooks and laptops in schools and at home (Vuorikori, Garoia, Baranskat, 2011, p.8). Every student from 245 classes of these schools received a notebook and every teacher received a laptop. One of the results of this study indicates that students use technology more outside of school than in class and that, when used in daily activities, students become more engaged, more motivated to solve school tasks, they focus more and collaborate with colleagues and teachers. Therefore, the research continues to confirm the results of previous studies. Moreover, the results indicate that students use technology to do their homework, to communicate with teachers, family and peers, to search new information, to create and edit multimedia documents, to edit web pages. Teachers involved in this study had average ICT skills. They recognized that using the laptops provided during the study increased their confidence in integration ICT in education and facilitated the access to various training opportunities regarding technology use in school activities (Vuorikari et al., 2011, pp.10-25). Furthermore, researchers consider that teachers access to laptops allow them to develop *"more varied and accessible curriculum"* (Cowie, Jones and Harlow, 2011, p.253).

In 2008, every Australian student had access to a laptop (Crook et al., 2008). Three years later, researchers' interest in the latest technology impact in education went beyond laptops' use in order to investigate the impact of iPads, iPod Touches and iPhones. The study was implemented in 10 Australian schools. The results indicate that these technologies not only that enhance student motivation, but they improve students' learning (Pegrum, Oakley,Faulkner, 2013).

In 2011, European Commission developed the Surveys *of Schools: ICT in Education*. This study involved 190.000 teachers, students (4th, 8th and 11th grade) and head teachers from EU 27, Croatia, Iceland, Norway, and Turkey. Aiming to identify ICT access, use and attitudes, the research revealed that students still use more frequently ICT at home, than at school (Wastiau et al, 2013).

4. ICT impact on teachers

The use of ICT in education can be achieved either as a deliberate intervention or as an intended change on organizing and carrying out activities (Ramboll Management, 2006, p 21). Each of these two strategies requires teachers' support, cooperation and commitment. However, teachers' involvement depends on their ICT beliefs. Furthermore, teachers' ICT training and ICT perceived impact are also important.

Researches aiming to identify ICT impact on teachers focused on identifying the main changes and on drawing attention on the issues that require more reflection, new policy measures and investments. An analysis carried out by Learnovation Consortium, indicates that using technology in education help teachers to become more motivated, increasing their leadership, improving the communication and collaboration (2008, p.5). The results from the *Surveys of Schools: ICT in Education* indicate that only 1 out of 4 European teachers had been involved in a compulsory ICT teacher training (Wastiau et al, 2013). Furthermore, the introduction of broadband Internet in schools has increased teacher confidence in using ICT, helped them to become more productive, improved the collaboration among teachers, and help them to reduce workload (Underwood et al., 2005, pp.26-31). However, a research developed at European level in 2006 reveals that 1 teacher out of 6 denies the existence of a positive impact of ICT use in education (Korte and Hüsing 2006, pp.4-6).

5. ICT impact on school and education practices

The introduction of technology in schools allowed the development of a centralized system of attendance, evaluation and registration, improved the communication between the school and the family, and facilitated national and international collaboration (Condie si Munro, 2007, p.7). In the last twenty years significant investment has been made towards ensuring ICT access in schools. Facilitating students' collaboration, ICT's are also valuable tools for achieving differentiated activities, developing individualized curriculum, contributing to the increase in quality of education and ensuring equal access to education.

ICT in schools has led also to the transformation of educational institutions in learning organizations. Learning organizations are defined as "*organizations where people continually expand their capacity to create the results they desire, where new patterns of thinking appear*" (Senge, 1990, p.3). In such an organization, where rapids change emerges, only those that are flexible, and can quickly adapt are the successful factors. However, the school "needs to discover how to increase the involvement, commitment and learning capacity of all its members" (p.4) if it want to have good results. Therefore, only those schools that identify and invest in teacher motivation and their involvement in the change management will be able to obtain good results. Researchers' opinions on this subject are divided. On one side, there is Senge which highlights teachers' involvement in taking all the decisions regarding the schools vision, than there are Perry and Aregaldo (2001) who sustain the need to clarify the school vision by the school management and Mehlinger and Powers (2002) who promote the development of a consistent vision at the ICT teacher training departments (apud Bai, Dong, Khalil, Park, Ertmer, Wang, 2002, p.482).

Consistency, clarity of vision and teachers' involvement in school decision processes are important since these factors are more likely to ensure a successful ICT integration in school. The successful implementation of a change in school depends equally on the involvement of staff, as much as its existing infrastructure and support services. This requires a coordinated approach in which the ICT integration is related to curriculum and teacher training changes (Hinostroza et al, 2008, p 83).

6. Conclusions

The analysis of the ICT impact on students, teachers and school practices revealed valuable results that can be considered as arguments to sustain and promote ICT initiatives at school, regional and national level. Technology's use in schools is an educational innovation that challenges how students learn, how teachers realize education activities and how schools proceed in their daily activities.

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Edmodo E-portfolios in EFL – A Case Study

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Abstract

Edmodo is a free and safe virtual learning environment, helping students and teachers connect and collaborate outside the face-to-face learning time, which makes it an ideal tool to be explored and adopted by teachers of English as a foreign language (EFL). Our case study will reflect on using the Edmodo Assignment feature as an ePortfolio of EFL student productions and progress. Written productions, speaking and listening contributions, which would be otherwise rather difficult to process and assess in real time, are accommodated by the platform and contribute to a finer assessment process. The outcomes and qualitative results of employing the Edmodo EFL portfolio for a mixed-ability group of undergraduate Geography of Tourism students, for two-semesters, are presented.

Keywords: Edmodo, e-portfolio, assessment, EFL.

1 Introduction

Recent research in EFL teaching/learning has demonstrated that employment of technology has manifold benefits for both learners and teachers (Chan, 2003; Genc, 2010; Karakas, 2012; Lai, 2006; Wang, 2008, 2009).

Edmodo is a free, safe version of a virtual learning environment, helping students and teachers connect and collaborate outside the face-to-face learning time. In some ways the interface is similar to Facebook as it allows teachers to create closed groups and sub-groups in order to work on different things at the same time according to students' proficiency, share links and discuss. Moreover, polls, alerts, quizzes and homework can be set, files with grammar sheets or reading materials can be added in the library for students to access at any time, whereas posts can be filtered by different criteria, all these making Edmodo an ideal tool to be explored and adopted in EFL. E-portfolios of writing, speaking and listening contributions, which would be otherwise rather difficult to assess in real time by the teacher, can be uploaded on the platform and contribute to a finer, more objective assessment process. Our case study will reflect on using the Edmodo Assignment feature as an E-portfolio of EFL student productions and progress.

2. Edmodo Project

A group of first year mixed-abilities undergraduate Geography of Tourism students (N=37 of a total of 110) studying English as a foreign language (EFL) at Dimitrie Cantemir University of Tirgu Mures, chose to work on Edmodo, after a brief introduction of the platform by the teacher at the beginning of their two hours/week course. These project participants became Edmodo group members and uploaded their assignments for two semesters during the academic year 2012-2013, also agreeing to reflect on their experiment at the end of the year. Besides the assignments which were basically designed on Tourism English, students worked on interactive exercises, games, announcements, answered polls, and a continuous exchange of opinions, questions/answers took place on the platform, in a desire to maximize the students' use of the foreign language in a communicative way.

The students' degree of satisfaction of working on Edmodo was measured at the end of the first year through a five-item questionnaire that referred to the participants' likes, benefits, shortcomings, difficulties and outcomes of exploiting the virtual environment in their English learning, reflections being collected as the final assignment.

2.1 E-portfolio

An e-portfolio of four speaking, writing and listening activities/each semester was made available online through the Edmodo assignment feature (plus the Final survey) and modelled by the teacher, due dates being established, as well.

A selection of the writing/speaking e-portfolio activities is showcased below:

➔ creation of a digital leaflet using Smore (**http://www.smore.com**). Students designed their own e-Flyer (Fig. 1) and applied the notions acquired in the course. The added value of creating online leaflets was represented by the facility the tool offered of inserting digital images and videos while at the same time making their writing public and, therefore, likely to receive comments from the real world.

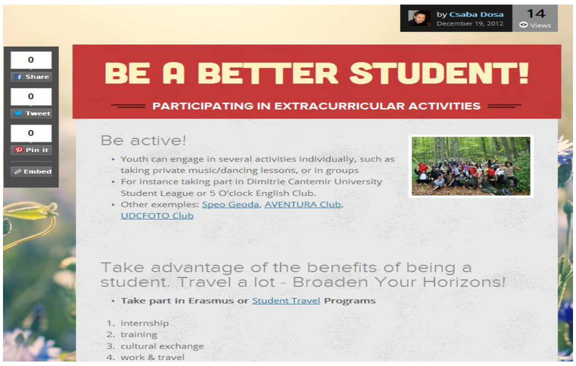


Fig. 1 Digital leaflet (https://www.smore.com/d1m3)

➔ group speaking project with VoiceThread (VT) (http://voicethread.com) (Papell, 2007). Students had to record their answers on tourism-based topics: trends in tourism (Fig. 2); flying experiences; a travelogue; basic destinations for Romanians nowdays (domestic and foreign holiday places); why should foreign tourists visit Romania; promoting a place through a story/ legend; the communist tour of the town (creation of a touristic product).

➔

Fig. 2 – Speaking with VT - Trends in tourism
https://voicethread.com/?#u621787

- ➔ creating a digital book (Fig.4) in which students described their favourite spot using **http://www.pimpampum.net/bookr/.** This tool enabled students to upload CC Flickr images and comment on them in writing. Students practised descriptive language and obeyed composition guidelines.

Fig. 4 Digital book - http://www.pimpampum.net/bookr/?id=45978

- ➔ Advertising the town with Littlebirdtales **- http://littlebirdtales.com** (Fig. 5). This task exploited writing and speaking skills, each slide including both writing and speaking comments while at the same time applying the tourism advertising language.

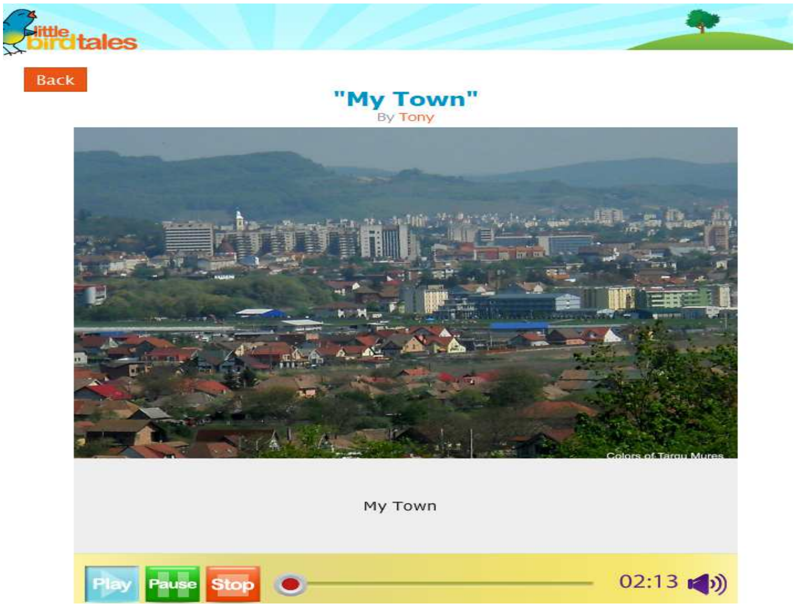


Fig. 5 Advertising with Littlebirdtales

- ➔ Report on Accomodation facilities in Tirgu Mures – practised report-writing skills and uploading word files on Edmodo.

3. Qualitative and quantitative results

Of the first year of Geography of Tourism undergraduate students, only 37 (34%) chose to engage in Edmodo EFL learning and assessment. Edmodo-generated statistics show that only 5 students were inactive, turning in either none or only one assignment. The rest of 32 students turned in all the envisaged assignments, thus contributing to a transparent, finer and more objective evaluation process due to the range of assessment strategies employed.

According to the end-of-the-year survey, the most interesting tasks for the students were “Advertising their hometown” and “Speaking for Tourism”, which indicates that adult students prefer tasks that are relevant to their field of specialization as well as tasks that involve creativity.

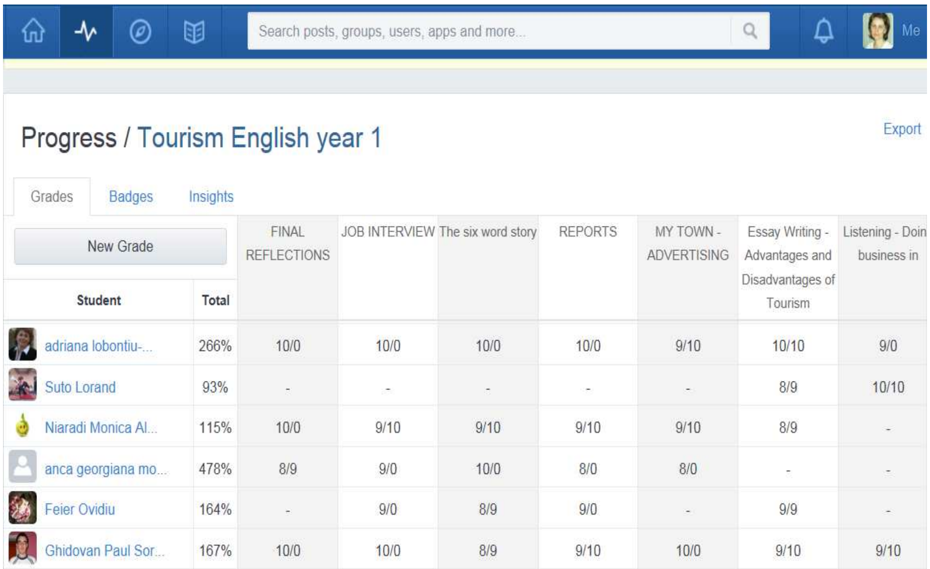
The speaking and listening tasks were perceived as more difficult than the writing ones because of technical issues involved (e.g.use of webcam, microphone) but on the other hand students appreciated they had autonomy and could decide how many times to re-record and thus improve their learning and outcomes.

Students had positive remarks on learning English with Edmodo, listing the following strong points: variety and novelty of tasks, interactivity of the site, use of the Internet in a creative way, platform user friendliness, and above all, the possibility to re-record oral productions or revise written ones until satisfied.

Students liked the creativity of this way of learning, they enjoyed to write and communicate with others in English outside the class, which is evident in the long list of Edmodo posts and comments throughout the year, and represents a crucial aspect for the progress of students learning the foreign language in an artificial environment.

Although most of the students had no problem in getting used to the novel, unconventional means of learning English with Edmodo, since a different speaking and writing tool was embedded for each activity, they found it inconvenient to create a different account each time – a shortcoming we will have to work on during the next year of the project.

For the teacher, Edmodo offered manifold benefits: assignment submissions could be viewed according to: all, ungraded, graded, not turned in or late; each student’s productions could be viewed either individually or the Progress feature could generate the whole class roll automatically (Fig.6)



Student	Total	FINAL REFLECTIONS	JOB INTERVIEW	The six word story	REPORTS	MY TOWN - ADVERTISING	Essay Writing - Advantages and Disadvantages of Tourism	Listening - Doin business in
adriana lobontiu-...	266%	10/0	10/0	10/0	10/0	9/10	10/10	9/0
Suto Lorand	93%	-	-	-	-	-	8/9	10/10
Niaradi Monica Al...	115%	10/0	9/10	9/10	9/10	9/10	8/9	-
anca georgiana mo...	478%	8/9	9/0	10/0	8/0	8/0	-	-
Feier Ovidiu	164%	-	9/0	8/9	9/0	-	9/9	-
Ghidovan Paul Sor...	167%	10/0	10/0	8/9	9/10	10/0	9/10	9/10

Fig. 6 Snapshot of Edmodo-generated Student progress

Limitations of these empirical findings would be the restricted number of participants as well as an Edmodo technical problem which does not allow peers to view each other's contribution. Examples of good practice-sharing with the whole group may be desirable especially in incipient phases of assignment turning-in when the rest of students are looking for further models. This has not been possible so far unless the teacher either makes the post public ('url' is generated) or sends the model contribution to the group as a note. Hopefully, the Edmodo team will develop this aspect in the future.

4. Conclusions

With Edmodo, written, speaking and listening productions, which would be otherwise difficult to process and assess in real time, contributed to a finer, more formative and reliable assessment process.

Participants in this one-year, small-size, class project showed high levels of satisfaction of working with Edmodo due to their possibility of sharing ideas with colleagues, keeping pace with class progress and especially for the ability the selected tools offered of amending their productions and, therefore, enhancing their learning and grades. Despite certain technical issues, task relevance and creativity ranked high on the list of strong points of learning with Edmodo in all the participants' responses.

For the EFL teacher, Edmodo offered effective monitoring and timely guiding, the possibility to customize activities according to proficiency level as well as to maximize all the students' learning time by offering them a safe platform where to continue to practise the target language.

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https://voicethread.com/?#u621787

Active, Collaborative and Constructivist Learning by Means of the new Information Technologies

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Abstract

The education system in its entirety is facing a social challenge represented especially by the development of information society: a strong demand from society for a genuine education based on new individual and collective skills; the accelerated rate of change due to new information and communication technologies; the demand for new forms of learning, less institutional, and with access to information and knowledge; new job applications in relation to training opportunities that require changes in education from individual competitiveness towards a development of teamwork skills; a growing demand for greater autonomy in planning options for continuous training (lifelong learning). The current research aims to analyze the impact of using new information technologies on learning.

Keywords: active learning, collaborative learning, constructivist learning, new informational technologies

Introduction – priorities in training needs

The trainer's effective use of new information and communication technologies, and even the Internet, in teaching subjects puts the trainee in front of challenges that he does not encounter when learning takes place traditionally (with a textbook, blackboard and overhead projector, etc.) and as shown in recent international studies, the Romanian education system currently suffers.

To learn in the new conditions, the individual must acquire a set of knowledge and skills in using these new technologies that become the instrumental and operational support for the knowledge he must develop. In addition to knowledge, which is important in the training and personality development, also important are the skills and abilities that the individual is training in solving teaching tasks according to agreed objectives. Modern teaching strategies, and we refer specifically to the use of new information technologies, facilitate the training of such skills required by contemporary society.

Analyzing the learning process in terms of using new information technologies in trainee's activity we intended, through our research, to monitor the impact and consequences of using such teaching means in Romanian education and the way in which they can lead to an active, creative, collaborative, participatory, responsible, engaged and constructive learning.

The purpose, goals and hypothesis of the research

The purpose of our research is to *analyze the efficiency of some very attractive and polyvalent teaching means (the new information technologies NIT), as well as their impact on teaching and learning.*

In this perspective, our research aims to achieve the following objectives:

- To analyze the contribution of NIT to the development of key skills required for the informational society;
- To identify the basic skills which NIT help develop;

- To define the necessary skills for personality cultivation on graduating compulsory education;
- To propose appropriate steps for the educational use of NIT in order to optimize learning and obtain high performances.

Our research hypothesis is to monitor how NIT *influences positively the teaching and learning activity facilitating active, collaborative and constructivist learning.*

We have closely followed this hypothesis analyzing the ways in which:

- NIT resources can be exploited in education in different stages of learning;
- The use of NIT supports students' performance improvement in the learning process;
- NIT supports interaction among students and between students and teachers;
- The use of NIT in teaching requires a specific training for both teachers and students;
- The use of NIT in education requires specific educational policies.

Research plan

The research plan included the following stages:

- The analysis of curricular documents (curriculum, school curricula);
- Applying questionnaires to teachers and students;
- Selecting the schools where the research was conducted based on questionnaires;
- Selecting teachers in order to monitor their teaching activities (NIT use) based on questionnaires;
- Selecting classrooms in order to monitor NIT-enabled learning based on questionnaires;
- Training teachers in the use of NIT for the purposes highlighted by our research;
- Establishing the lessons and implementing the lesson plans and evaluation worksheets, in parallel with
- Establishing the NIT resources to be used in teaching;
- Conducting, monitoring and analyzing the lessons;
- Interviews with teachers and students after conducting the lessons and filling in the evaluation worksheets to identify the types of behavior developed by NIT use;
- Identifying the advantages and limitations of NIT use in learning;
- Identifying communication, socialization and personal development skills using NIT;
- Identifying psycho-pedagogical, informational and communication skills that teachers require in order to use NIT in teaching;
- Identifying the training needs for teachers and education managers in view of using NIT in teaching;
- Drawing conclusions.

Selection criteria for the schools involved in research

To choose the schools involved in the project a questionnaire has been applied for a sample of 10 schools and the following were envisaged:

- Computer equipment – a minimum of 15 computers in a lab or the existence of labs specialized in physics, chemistry and biology equipped with minimum 8 computers;
- The presence of a network sys admin for monitoring and maintenance;
- The existence of computer trained teaching staff and management staff;
- The existence of teaching staff (other than IT teachers) that use computer and Internet in classrooms.

We chose schools located in Prahova County (the county with the largest number of teachers in Romania). In choosing the schools we took into consideration that students generally come from families with a social level above the average, most of them attend boarding schools and take IT classes since first grade. Schools are equipped with a specialized computer lab but there is also a primary school classroom equipped with computers that was included in our research. The choice of these schools was made considering there is at least a dedicated computer lab, a "computer assisted" physics lab and a biology lab equipped with computers, video projector available to teachers and multimedia applications for teaching science.

For the research section, where we observed the use of NIT in collaborative projects, we focused on schools with at least 5 years experience in such activities.

Selection criteria for teachers participating in research

Selecting teachers focused primarily on teachers who showed willingness to participate in the research project, have varying levels of training in information and communication technology (ICT), but increased interest in using these new technologies in teaching. Using the survey technique applied to a sample of 200 teachers, the following selection criteria were taken into account:

- The degree to which teachers know their classes and are able to assess whether objectives have been reached;
- The degree to which teachers know the status of the home computer equipment of their students;
- Adequate allocation of time for planning the classes with the help of computers and Internet;
- Organizing activities in groups of students for exploring and discovery;
- Interest manifested for cooperation with other teachers;
- Use of modern, non-traditional instruction means: encyclopedias, Internet, ITC tools;
- Use of non-traditional methods in evaluation;
- The level of monitoring and guidance of students in activities like searching, gathering and organizing information;
- The level of student guidance in activities run while consolidating knowledge;
- Designing work activities involving forms of collaboration among students and organizing the class in small workgroups;
- Designing work activities involving the exchange of learning experiences among students;
- Using methods to create an intrinsic learning motivation in students;
- The use of computer in their relation with students in the classroom, in the dedicated lab or outside class for finding information, making multimedia projects, expressing creativity, simulating phenomena, for evaluation and cooperative learning activities;
- The computer use skill levels in preparing class materials, finding information for personal interest, using e-mail to communicate with others, using the Internet to participate in collaborative projects and to support students in finding the useful information for their progress with school activities;
- The use of computer and Internet in class to learn new information, to motivate students, to improve school performance, communication among students and between students and teachers, to find information including for the purpose of securing a new job;
- The degree to which teachers are aware of the constraints in using computers and the Internet in classrooms;
- The use of computers and Internet for more than 10 hours both in class and at home.

Of all teachers surveyed were elected eight teachers of different disciplines; those eight were monitored in their teaching activities at different levels of education based on a systematic observation scale.

The limitations of the research

From the point of view of the covered area, the limitations of our research are determined by the extent of the issue – the use of NIT for educational purposes.

In terms of the actual area covered by our research (what we might call a surveyed sample area), the limitations are determined by the concreteness of the process of computerization of the Romanian education system, a process that is currently in a transition phase where the main problem is the computer literacy rate of teachers.

In this stage the general characteristic is the integration/assimilation of ITC among the traditional teaching methods; it is the time when teachers learn/improve their ITC skills but from the perspective of the teacher centered teaching methods.

NIT use requires a new methodological opening with implications in education. Hence, on one hand, stems the advantage of a broader extension of educational outcomes but, on the other hand, there are the disadvantages or limitations in terms of research.

In this evolution stage of the computerization process in education the number of schools where prospective research of this type can be conducted is small, especially when investigations are attempted that presuppose a different pedagogic training of teachers than what existent teachers benefited from.

Moreover, student centeredness requires a curriculum and an institutional organization built on principles that are different from the ones we have today.

As limitations of the research, without claiming an exhaustive approach, we identify:

- Our research does not attempt to comparatively analyze the effectiveness of Internet use against other traditional teaching means;
- Our research does not attempt to comparatively analyze the effectiveness of Internet use against other ITC means;
- The limited material and financial facilities of Romanian schools in the beginning of our research did not allow for a complete analysis of the use of all NIT resources.
- Due to the level of training teachers have in the use of NIT we could not select a representative sample nationwide. Thus, the number of subjects was limited to eight, teachers of different disciplines. Only eight teachers were observed directly in their teaching activity in classrooms, within the limits of the available time.
- The time allocated to the research did not allow a study of the initial and continuous training;
- Due to the peculiarities of the disciplines and other factors involved (e.g. the inexistence of dedicated labs and classrooms equipped with computers and Internet connection, etc.) that influence the educational process, our research envisaged the study of Internet use in four of the seven curricular areas (Language and communication, Mathematics and Sciences, Man and society and Technologies).
- Our research does not cover all the versions and types of lessons for all disciplines and thus, the comparative conclusions are limited to lesson titles within the same discipline or to lesson types for different disciplines.
- Our research did not attempt to analyze historically the consequences of NIT use in education since its dawn.

Conclusions

Teachers consider that in order to use NIT in education and to assume the roles specified above it is necessary to have a proper training; in this respect they have stated the following necessary training directions:

- The correct use of NIT and its resources;
- Evaluation of existing NIT resources and the selection of the most useful ones for the teaching process;

- Classroom management for the situations where NIT is used;
- Effective communication in collaborative activities;
- Student evaluation techniques specific to NIT based activities.

If the teacher's role changes we can talk about a change in the role of the student, which is perceived by teachers as an advantage in that it puts *the student* in the center of education as an *active participant* in the production of new information and the teacher becomes a facilitator and participant together with the students in this process. Teachers find that special attention should be given to planning lessons and preparing students to assume any of the roles that they are entrusted with in using NTI in the teaching process:

- *Creative problem solver:* to be able to define the problem by analyzing a particular situation specifying the objectives and identifying discrepancies between the actual situation and the desired situation, to use previous knowledge, to gather and create new knowledge to propose solutions, to evaluate side effects that may occur, to analyze the outcome after understanding a proposed settlement, to use new knowledge to improve other problem solving processes;
- *Project coordinator:* the student must be capable of elaborating a project, set the stages for its completion and control the course of action, make decisions and assume responsibility for the success or failure of his attempts;
- *presenter:* the student must be capable of providing ideas, knowledge, opinions or solutions to the problems intelligibly and in a way other students find interesting;
- *documentary author*: the student must be capable of documenting a problem solving process intelligibly and make it available to other students;
- *self-interrogator*: to improve his own understanding and others' by asking profound, rational questions;
- *evaluator and rational analyst***:** to evaluate his own and others' solutions to the problem in terms of objectives, means and quality criteria, to reflect critically on his own attitudes, goals, actions and perceptions.
- *expert and disseminator***:** to gain technical knowledge in a certain field, to transmit that knowledge to other students.

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The Impact of Internet Use in the Learning Process

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Abstract

Our research showed that an important benefit offered by the use of Internet is opening a stock of interactive media resources available globally. This information offer allows both students and teachers access to materials, the latest news and data. Teachers can collect process and exchange teaching and learning materials to use in their classes. Students can explore areas of interest in an organized manner, individually or collectively. The information found can be used for planning, problem solving activities, homework and writing essays. This additional source of information is essential for creating more student-centered learning environments, exploration and research environments, in which the teacher takes other roles than the sole supplier of information. Using the Internet as a medium of learning increases student self-control in that we can talk about behavior and involvement oriented towards reaching goals.

Keywords: Internet, learning, teaching means

Effectiveness and limitations of Internet as teaching means

The research was conducted on 200 teachers from various disciplines at all levels of pre-university education in schools in Prahova County, in both rural and urban areas.

The educational valences of Internet, especially the advantages and limitations as a means of education were analyzed and interpreted based on the open responses of teachers and pupils in the questionnaires. In the teachers' questionnaire there were items related to information on Internet use in preparing and conducting lessons and information for personal reflection - have been developed to allow feedback on the self-assessment of teachers' activity in the lessons observed.

The students' questionnaire developed two items with open ended questions about information on student attitudes towards ongoing lessons - pursuing the same objective of getting feedback from the students.

Self assessment for teachers

For all interviewees Internet represents a teaching means, a tool at their disposal to facilitate learning. The answers to one of the items together with free discussions with teachers highlight the fact that teachers consider that *the use of Internet can be extended to all types of lessons.*

At educational level an effort must be made to exploit to a maximum the potential offered by Internet and also solutions must be found to integrate it into as many activities types as possible. That is exactly how we can summarize the teachers' answers to item 2 regarding the hierarchy based on personal criteria of the types of effective teaching activities using Internet as a resource.

For primary education the primary teacher considers useful the independent activities, methods based on teaching games and learning by discovery. For disciplines in the curricular area "Language and communication" teachers consider useful the independent activity method, communicating via electronic mail, learning by cooperation, conversation and learning by discovery. For the disciplines in the curricular area “Man and society” methods based on independent activity, those based on discovery and learning by cooperation present a high interest whereas for disciplines in the curricular area “Mathematics and natural sciences” the most common methods used in combination with Internet resources are learning by models, learning by experiment, learning by discovery, by case study and by cooperation.

At item 3 teachers have mentioned the most frequent difficulties in planning the lesson: *lack of a specific training in using Internet, choosing the adequate teaching method to correlate with an Internet resource that is efficient in relation with the learning process; identifying evaluation tests in accordance with school curriculum; finding databases with numerical values suitable for statistical calculus; identifying accurate informational resources, adapted both to the lesson theme and the age of pupils; slow Internet connection at home and the lack of adequate equipment at school; large amount of time allocated for finding information (*all teachers involved*); much useful information is available in English and can be used as information database only for pupils in intensive English classes;* the advantages offered by Internet in planning and preparing lessons are:

- *Existence of applications suitable for pupils with good graphics;*
- *Finding sites with adequate graphics and well structured information*;
- *Audio, video and text elements in one place;*
- *Information in English that is accurate and well structured*;
- *Virtual experiments that are difficult to put in place in a lab*;
- *Applications for online learning that is interactive and easy to use;*
- *Existence of databases that can be imported and processed for statistics;*
- *Abundance of information in any field of activity*;
- *Access to any type of information for personal documentation;*
- *Downloading Web applications, pictures, text copying and their use in preparing teaching documents* (almost all teachers).

As analysis of the lesson development all teachers consider they failed to respect the time available, as planned, because of technical and logistic disturbances: *Access speed depends on the type of Internet connection and the number of computers in a network. These parameters must be considered in planning the lesson especially when activities being run are virtual experiments*; *Internet use, as is the case with any multi-media resource, as well as the collaborative work activities take longer than a typical lesson.*

One solution to reduce search times is when the teacher leads the work activity directly to a specific website, which involves a thorough planning of the lesson – localization, tracking and downloading the site – as well as a decision regarding ways of using the chosen resource.

The attitudes developed by pupils regarding Internet use during lessons are of acceptance, involvement, use of the educative valences of Internet but there are also some difficulties remaining attentive on the sites previously proposed by the teacher that develop the lesson theme.

As a solution, due to their experience in teaching, teachers have adopted working in groups therefore the pupils’ joint interest eliminates any possible disruption from their purpose.

Another inconvenient noticed by teachers is that pupils better at using Internet and computers tend to take over the entire responsibility of the activity whereas weaker pupils tend to become inactive.

A possible solution to solving this difficulty is to attempt heterogeneous groups and to render each pupil responsible with well established work tasks. Team activities also generate *conflicts* that have to be mediated by a teacher. Often conflicts are constructive and stem from a different understanding of the identified information therefore mediation leads to finding the scientific truth that indirectly causes learning.

The approaches of learning by cooperation can help *overcoming the isolation feeling* that can emerge in a technology-based learning environment and can lead to developing social abilities like communication. We have noticed that:

Pupils contributing rarely to class discussions are more enthusiastically taking part in the electronic equivalent of these discussions because social barriers can be reduced in the electronic environment and, on the other hand, some pupils are frustrated by the guidance involved in collaboration, because they cannot act individually like they were used to, having to consider alternatives proposed by other members of the group.

An aspect of interest in our research is the attitude of pupils with outstanding results as well as the rest of the pupils. Pupils in the first category manifested:

- Abilities and skills in processing information to understand and learn about the material in a coherent way;
- Skills in elaborating new information and connecting it with already learnt knowledge;
- Responsibility towards imposed goals, freedom and interest in obtaining the desired results;
- Occasionally tendencies towards individualism, solving work tasks independently.

Using Internet offers a framework of *effective learning, an environment that is open, active and interactive with a high degree of freedom and responsibility from the pupil.*

For the second category of pupils, using Internet, in its different working versions, has increased *motivation to learn, stimulated visibly their intellectual curiosity and pleasure to learn therefore pupils went from the passive role of information receptor to the Active role of knowledge producer* as declare the teachers involved in the project.

Video images offer information that can be authentic and full of challenges for stimulating the sensorial apparatus of the pupil, a stimulation made by use of images, colors, sounds and movement which increases the interest for study and solving work tasks. Another advantage is that *Internet makes things appear more real than in books. The possibility to extract much information very quickly, to use colors, sounds and animation will attract and challenge pupils to learn.*

It is true that situations of passivity have been registered in the second category of students *that were waiting to obtain the results to fill in the worksheet and finish the work task* because of the tendency to dominate in the students of the first category.

Foreign language teachers consider that:

One of the teaching principles that are essential for learning a foreign language is putting the stress on the language study in its cultural context. Language and culture are inseparable and interdependent. Understanding the culture of a certain country increases the knowledge of the language itself. Electronic mail offers the possibility to communicate with native speakers facilitating learning for all pupils. This communication with native speakers of a language develops the knowledge in a certain field, allows pupils to form an opinion in a certain matter and to exercise their negotiation skills, their ability to convince others, to clarify, to ask for information and to engage in discussions over real issues.

All pupils involved in collaborative projects *have benefited and have been engaged into an activity also showing responsibility for the success of the team.*

Technical problems are common in computer lab activities. Teachers consider the most common are related to missing network cables, web browsers like “Internet Explorer” not being installed and no Internet connection. Thus, teachers think that during the initial moments of experimenting computer use in class technical problems *created panic and the presence of a lab technician during classes was a must.* In time, technical problems were overcome by teachers themselves or by involving pupils in solving them, especially in classes specialized in mathematics-IT. Computer-literate teachers that have acquired their skills by specialized training and teaching experience in using Internet find solutions to potential problems by preventing them thanks to approaches that are carefully planned from the stage of lesson preparation. For example, to prevent potential problems with Internet connection one solution is to save *the site on the local server before class starts so that it does not disturb the activities.*

Another aspect of interest for the current research is the interaction between pupils and between teachers and pupils. Most teachers consider the potential brought by Internet in education makes for a constructivist learning and encourages communication between pupils and between pupils and teachers. Collaborative working tasks may lead to conflicts that can transform into positive interactions like an exchange of opinions.

The relationship between pupils is a collaborative one, a mutual support for reaching objectives and accomplishing tasks. This relationship, as well as the one between pupils and teacher intends to effectively organize classroom by:

- Formulating specific learning tasks and their presentation
- Stating the way in which assessment will be conducted
- Negotiating responsibilities for every member of the team
- Monitoring and directing pupils' activity
- Evaluating all pupils inside a team based on allocated tasks.

Teachers consider that Internet use in class determines positive attitudinal changes in relationships between pupils. Thus, pupils work in teams; they make common efforts to fulfill mutual goals. They learn from one another. They have displayed an active and open attitude, engaging in solving work tasks. The relationship between pupils and teacher has been a collaborative one with the teacher monitoring the activity and intervening only when asked.

As we intended in the beginning of our research, Internet use was treated from the point of view of a teaching resource. What we focused on during class development were the set objectives. In the assessment of the lessons for which Web applications have been used, teachers consider that the *objectives were reached and that for common items in the written worksheet and the Web application pupils have obtained better results and they were also more relaxed during the computer-based activity. The result was accepted with more detachment.* All objectives were met as well during the lessons of *systematization and revision for the purpose of securing knowledge.*

Being a committed learning process, pupils have taken responsibility for the proposed objectives and have conducted activities to attain them. Following the completion of the educational process teachers consider that certain aspects regarding *classroom organization* must be kept and others must be observed in the future. In terms of class management teachers consider that for any collaborative activity in which Internet is used one must take into consideration the following:

- Size of groups (2 -4 pupils).
- Homogeneity vs. heterogeneity of the learning level of groups – groups made of weak pupils as well as groups made of very good pupils should be avoided. First, stronger groups have an unfair advantage on other groups in the class. Second, members of the team have the tendency to divide tasks and communicate only occasionally, excluding the dynamic interaction that is proved to be the main benefit of learning by cooperation. On the other side, in mixed groups weaker pupils win by observing good pupils study and tackle problems, and good pupils win by a greater understanding of the subject by learning and explaining it to their colleagues.
- Acknowledging pupils' perception of competition within group and among groups – each member must have a unique task and be aware that the work task cannot be accomplished without him/her.
- Creating positive interdependency (awareness of the individual's dependency on the group regarding results to different levels, for example the interdependence of goals, the interdependence of resources, interdependence of roles, of duties, of time, etc.).

- Facilitating the interaction between the pro-social behavior and attitudes (management, conflict solving, positive criticism, negotiation, encouragement, etc.).
- Ensuring access and understanding of information.
- Ensuring necessary time for the management of responsibilities.
- Individual and collective assessment.

Another aspect noticed by teachers is related to working time. Planning these activities requires much working time which implies a curricular reorganization. That is why using Internet resources must be done only when it renders the teaching-learning process more efficient. Using Internet can be a complementary activity, outside classes, to allow pupils to deepen the knowledge acquired during class. Teachers must prepare pupils for carrying out collaborative activities, to develop team spirit, cooperation and constructive competition, to find ways to get involved directly, actively and interactively in learning new things, to accept success as well as failure. Teachers with more experience in the use of new ITC in teaching consider that:

In the beginning it is more difficult to accomplish cooperation within groups and it is important that groups to change the way they are structured in order to avoid getting used to one another and developing friendship ties all which could lead to a decrease in interest for the proposed theme and a focus on other activities of common interest like surfing the Internet.

Using Internet also determines the *development* of logical thinking skills. Surfing the web requires a specific thinking from the user's part, the information must be analyzed which requires assessment and discernment skills from the pupil as user. Information must be systematized to obtain a coherent whole which in turn necessitates a synthesis process.

Internet represents a means to get to know and provide creative work. Pupils can read and retain information on the Internet but they can use it as well for personal papers like essays, poetry or novels. His type of activity is specific to cooperative projects. Pupils thus become not only consumers but also producers of information.

Acquiring new knowledge also has a social connotation. Interactions that occur in previously mentioned situations may lead to the development of social skills so needed in current society; the use of Internet leads to the increase of knowledge about computer use and computers in general.

In the item related to other complementary forms of Internet that can be used, teachers consider textbooks to be still useful with the major difference that Internet use can challenge pupils to travel in time and space. Films, audio and video technology, computers, Internet they all bring sound and movement in the static environment of textbooks. Atlases, multimedia applications, video cassettes are still usable means but for the pupils studying foreign languages the use of Internet can offer unique communication experiences with native speakers.

Simulating and watching physical, chemical and biological phenomena may take place in lab conditions or using presentations from multimedia encyclopedias but Internet use has more interactivity for these applications, offering the possibility of assessing situations of the "What happens if…" type, and which transform the risks and expensive experiments into safe and cheap procedures.

Web applications for evaluation and self-evaluation allow access independently on time and place. They can be replaced by collections of problems or multimedia applications on CD ROMs but, for the latter, they must be installed on the work stations and they also require a user license. Some web applications are downloadable for free on work stations or on any other equipment which increases the portability of the application.

Teachers consider that Internet, like the majority of the new ITC is helpful in gaining independence, self-regulation and creativity only if there is a controlled learning environment, with enough equipment and well trained teachers.

Analyzing the development of classes from teachers' perspective, based on their personal reflections, it was observed that their role has changed. Teachers not only provide information but they focus on the following tasks and responsibilities:

- *catalyst/inspiration source*: actions are oriented towards stimulating pupils' curiosity by working together, to suggest areas of content that pupils might research during classes and outside school;
- *explorer:* researches new spheres of knowledge and prepares an adequate instruction path;
- *consultant and counselor*: observes and, together with the pupils analyzes the individual learning processes, reacts to performances and stimulates improvement;
- *instructor*: explains and teaches according to pupils'; needs;
- *mentor and educator*: presents, debates and justifies values; elicits and supports moral judgment;
- *moderator*: shares and supports the debates and claims based on content;
- *arbitrator and intermediary*: acts as court if there are any conflicts and helps pupils to solve their own problems;
- "*devil's advocate*": contests solutions that are too easily or too quickly reached, or superficial opinions of pupils; requests explanations and thorough justifications from pupils;
- *element of appreciation and actuality*: represents an authority accepted by pupils, evaluates their suggestions together with other pupils, checks whether pupils keep themselves within the influence of learning objectives.

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Web application presentation of timetable for a university website

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Abstract

This web application presents into an attractive form the timetable of a faculty of a university. The web application is created with the usage of PHP language combined with MySQL for databases, HTML, CSS and JavaScript. It also contains forms used by an administrator to log in, insert or delete classes in order to create the schedule. The content comes from databases and is modified and outputted with specific web developing languages. This type of timetable helps the students to inform about their classes using an easy reliable way.

Key words: PHP, MySQL, Web Application, CSS, HTML, JavaScript

1 Introduction

The purpose of this project is to present a web application that uses specific programming languages in order to build a timetable that can be used for universities. In the first section, we will introduce more detailed the purpose of this application, as well as the web languages that were used in this process. In the second section, we will describe the parts of the application that consist in the pages that were created. The next section describes the algorithm that solves the display of the timetable and in the last section several short conclusions are made. This application can be related to the programs that are designed to generate a schedule, presented in [1], [2], [3], [4] or like in the case of [5]. In this application we give the example of the Faculty of Management, Economic Engineering in Agriculture and Rural Development from Slatina, Romania,[6] with few modifications.

After D. Abramson, the importance of a timetabling problem is wide, because universities make timetables every year [9] and has been studied over the last decades [10]. As a result, a timetable is always a mandatory thing for a student. This is essential for him to know where his classes are being made or what he should prepare for the next day. A typed schedule is typical for showing the structure of the classes, but nowadays more and more faculties and even schools upload their timetables online. This way has several advantages, just one of them being the fact that they can visualise the structure of the classes online, not being necessary to go to their faculties to see it.

In this matter, we developed an application for displaying a timetable for the students of a faculty. This project is realised in the form of a website, using HTML, CSS, PHP language and MySQL for managing the databases where the classes and more information is stored. JavaScript was also used for displaying the windows for additional information.After their words, MySQL is “the world's most popular open source database” [8] and PHP is a server-side scripting language designed for web development but also used as a general-purpose programming language. PHP is now installed on more than 244 million websites and 2.1 million web servers [7]. Along visualising the schedule, the application permits to an administrator to modify the information that is displayed. There can be modified by inserting new information or deleting it. In the next rows, we will present it more detailed, every component of it being described separately.

2 Describing components

First page

The first page is a simple one, its structure being formed from one table that separates the webpage in several important parts. CSS is used for the style of some elements in HTML. The schedule is separate for every year and semester. Every button, when pressed, calls a PHP script that connects with MySQL databases to show the timetable. Every year has two semesters and each semester has one or more series that contains one or more groups. Their number can be modified according to the university.

Pages for timetables

Webpages that display the classes have also a simple structure; they are sorted by the weekdays. They are created in HTML, styled in CSS and the information is displayed using PHP. Practically, these web pages have a .php extension, which transforms them in PHP scripts. The method is simple: the order is stored in a MySQL table and displayed in the PHP script. Every semester has three series, every series has three groups. Their number can be modified.

Luni	Marti	Miercuri	Joi	Vineri
Engleza Prof. Univ. Dr. Victor Tita	**Economie** Prof. Univ. Dr. Gheorghe Stan	**Pedologie** Prof. Univ. Dr. Profesor Univ. Cineva	**Matematica** Prof. Univ. Dr. Prof. Univ. Neacsu Silviu	**Franceza** Prof. Univ. Dr. Nicolae Draghici
Franceza Prof. Univ. Dr. Nicolae Draghici	**Botanica** Prof. Univ. Dr. Olga Florica	**Agrotehica** Prof. Univ. Dr. Nijloveanu Daniel	**Pedologie** Prof. Univ. Dr. Tita Victor	**Grafica** Prof. Univ. Dr. Profesor univ.
Istoria culturii Prof. Univ. Dr. Tita Victor	**Agrotehica** Prof. Univ. Dr. Nijloveanu Daniel	**Pedologie** Prof. Univ. Dr. Tita Victor	**Microbiologie** Prof. Univ. Dr. Ion Bozga	**Sport** Prof. Univ. Dr. Ion Man
Franceza Prof. Univ. Dr. Nicolae Draghici	**Informatica aplicata** Prof. Univ. Dr. Prof.univ. Lector Doru Popescu Anastasiu	**Engleza** Prof. Univ. Dr. Victor Tita	**Agrotehica** Prof. Univ. Dr. Nijloveanu Daniel	**Pedologie** Prof. Univ. Dr. Tita Victor

Page for modifying

This page contains four forms that help the administrator to modify the information in the MySQL tables. The first is destined to insert a class in the database, the second is for the order table, the third is for deleting a class from the database and the last one is designed for deleting the entire schedule for a semester in a year. The page has also a link that can be used by the administrator to log out. The webpage is actually simulating a simple MySQL administration panel for databases. The administrator should know the configuration of the tables in order to introduce the correct information for the timetable.

3. Algorithm of displaying

The application is using MySQL functions that connect with PHP. The structure of the database is the next one: four tables for each year, two for semester I and two for the semester II. One of the tables used for the first semester is built for the names of the course and the professor that teaches it and the other one for the order of the courses in the timetable, which is actually the one which helps at the display of the schedule. The other tables are mostly the same, the semester or the year being different. For printing the classes, a join between the two tables is built and the interrogation is called for the visualisation of the schedule. The column that unites the two tables is the code of the class and the order is given by an auto increment column.

The tables are updated/modified with the help of the page we reminded in the previous rows. The modifications are simple, consisting in the call of simple MySQL command lines: for inserting (the command line *INSERT INTO...*) and for deleting (the command line *DELETE FROM...*).

Cod curs	Nume	Profesor

Structure of the first table

Cod	Cod curs	Zi	Ora	Grupa	Serie

Structure of the second table

As it can be seen, the field “Cod curs” is common to both of tables.

4. Conclusion

The need of information nowadays is extremely strong, and, as a result, students must be informed precisely and fast in matter of their planning. In our opinion, every faculty is obliged to load on its website a page that allows all the persons who have an interest in their timetable to visualise it. Our application is a first step that a faculty has made to have an updated website. This form of the project can be developed and we could say that other updates are possible to be made. It is only a starting point in having informed persons and probably in attracting more students by maintaining an up-to-date website. The online activity is a plus for every faculty and it can bring more students to apply for a university. Obviously, this is a non-determinant factor in a decision of a student, but an organised internet activity can stand in front of the choice of students.

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The introduction of digital educational resources to the educational process as a condition of Kazakhstan education modernization

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Abstract

This article examines the extensive program of of education informatization RK, the design and implementation of digital educational resources in the learning process. Paper demonstrates a fragment the development of DERs in mathematics for pupils, and also features the use of DERs in training.

Keywords: ICT impact, technology integration, school education, informatization education

1. Introduction

In 1997, Kazakhstan adopted a program of educational informatization for the first time, established by the Decree N 3645 of the President of Kazakhstan [1]. State program of educational development was defined as a task of e-learning introduction. In this regard, the country began to create conditions for the implementation of the UNESCO declared with the leading principle of the XXI century formation "education for all" and "education through all life» - «Life Long Learning (LLL)» [2]. Without the use of modern information and communicative technologies is impossible to imagine the educational process that meets the requirements of modern society. The role of information and communicative technologies as providing quality modern education is regarded as a key element of the modern school.

Introduction of modern educational technology in the learning process and the development of skills to work with a qualified digital educational resources (DER) based on the opportunities of the Internet is one of the priorities in education. This, in its turn, creates the ability to search and find important information, analyze the data, organize results, in a proper way and accurately prepare and submit relevant information. It is known that the computer will give into the hands five new pedagogical tools: interactive, multimedia, modeling, communication, productivity, the use of which are directly dependent on the efficiency and quality of digital educational resources. And if so far the first three tools are used primarily in the electronic media on the local drive, the last two are the online resources. DERs new generation simultaneously use all of these tools and teaching are highly interactive, rich multimedia e-learning products, distributed on the global computer network. Solution to the problem of network multimedia DERs creation calls for a new architecture, unifying structure content components electronic educational products, and develop a common software environment functioning. On the methodical association of teachers website [3] written, that digital educational resources are the digitized photographs, video clips, static and dynamic models, objects of virtual reality and interactive modeling, maps, sound recordings, symbolic objects and business graphics, text documents and other educational materials which are necessary for school organizations.

In addition with the requirements of modern DER , written as they should not be:

- Represent an additional chapters to the existing textbook;
- Duplicate a shared background, popular science, culture, other information;
- Be based on materials that are quickly losing credibility (obsolete).

Currently DER s are grouped into the following types:

1. A set of digital educational resources, extending tutorials (it the digitized pictures, video, static and dynamic models, objects, virtual reality and interactive modeling, maps, sound recordings, symbolic objects and business graphics, text documents and other educational materials necessary for the educational process).

2. Information sources of complex structures (ISCS). ISCS is a digital learning resource, based on structured digital content (text, video, audio recordings, photos and interactive models, etc.) with the appropriate training and methodical support, to support students and teachers in one or more topics (sections) domain or provide one or more types of training activities within a certain subject area.

3. Innovative educational-methodical complexes (IEMC). IEMC is a full set of training required for the organization and conduct of the training process, which is due to the active use of modern teaching and information and communicative technologies should ensure the achievement of learning outcomes required to prepare students for the information society, including: basic general education, the ability to learn, interpersonal skills, teamwork, ability to think and act, and the ability to solve non-traditional problems using acquired substantive, intellectual and general knowledge skills[4].

In the world of educational practice increasing the share of digital resources. If in 2007 equipping with digital resources in Kazakhstan are in the range of 5% to 36%, then in 2015 e-learning is planned to cover 50% of educational organizations, and in 2020 to increase that to 90%, in organizations of all levels of education. In Russia, the share of educational institutions that use DER in educational activities in 2012 reached 95% [5,6]. Proved that the use of ICT in education is 3 times intensifies the learning process, at the same time is 2-3 times better quality of education, which is confirmed by scientists and educators of different countries (the USA - Seymour Papert, professor, founder of the educational philosophy of constructionism, India - Abdul Waheed Khan, Assistant Director General, Russian Federation - Institute of Information of RW Robert IV, Kazakhstan - Scientific School professor Gul' Nurgaliyeva) [7]. Computerization has become the main mechanism for the educational reform in Kazakhstan. On the state level a number of regulations that determine trends in educational informatization.

2. The State Programme of informatization

In 2001, the State Programme of informatization of primary and secondary vocational education was accepted. Approved Interagency program "Internet is for the schools." In October 2001, Almaty hosted the International Forum "Informatization of education in Kazakhstan: a step in the XXI Century", invited more than 300 representatives of other countries - experts in the field of modern information and communicative technologies of education. Reffering to "Information and communicative technologies in the curriculum (mandatory)" developed and approved:

1) State standard of secondary education;
2) State standard of primary education;
3) State standard of vocational education.

In terms of informatization today we can see radical changes: the activity and teachers functions, the nature of the subjects of the educational process, the methods of cognitive activity of students and the nature of their independent work, methods of training and nurturing, forms and methods of control, etc. Introduction of modern ICT in the educational system is a breakthrough that can significantly change not only the quality of the organization of the educational process, but also provides high performance school and vocational training, fundamentally changing the nature of learning from verbal to the functional activity-teaching.

National Center of Informatization (NCI), created by Gul' Nurgaliyeva and Research Institute of Mathematics and Mechanics (MM Research Institute) at the Kazakh National University named after Al-Farabi, under direction of academician Danaev N.T., actively engages the development of informatization education problrms. Electronic educational publications of MM Research Institute, included in the list of textbooks that are allowed RK Ministry of Education for use in educational institutions in the 2011-2012 academic year [8]. Pedagogical researches in the field of educational informatization are now the most popular, as it in Kazakhstan the extensive program of information at all levels of education is conducted: computerization and internetization, technological and technical support, development of national digital educational resources and the development of information and communicative networks, teachers training to professional activities using ICT.

On the basis of NCI actively conducting research is on the use of ICT in education at all levels. It is extremely important that the translation of the content of the educational process and technology to modern electronic media can only be made provided that the achievements of science and its teaching methodology as a fundamental basis for the design of modern teaching techniques using ICT. Studies conducted in the NCI is comprehensive and integrated, which meets modern requirements for science are merging, the interpenetration, the integration of many scientific fields [2, 9]. The effectiveness of the development process of e-books as computer applications training was scientific and educational research designed on principles of e-books, modeling technology of the electronic textbook. There is evidence that electronic textbooks (ET) have a huge impact on improving performance and, more importantly, on reflection student goals and objectives of an academic subject, on the interpretation of their educational opportunities. In the experimental schools NCI proved that performance of children who work on electronic textbooks, increased by 2-3 times, while the learning process is enhanced by 3 times. Graduates of these schools, 80% of the total number reaches a threshold level during the delivery of united national testing (UNT).

The new state program, which is in line with the e-learning system is introduced the system sets the development of digital educational resources, as the lesson of teaching materials.

According to Gul' Nurgaliyeva data 3837 students from 5267 students responded that they like to listen to the teachers' explanations with the use of these resources. 4405 students reported that learning became much more interesting, 4344 students started understanding the material better. The students survey results confirmed and the data obtained from teachers questionnaires. Teachers of pilot schools indicate that the use of DERs in class maximizes the visualization of the studied material, activated cognitive independence of students, expanding opportunities of learning quality. 83.1% of teachers who work in final classes believe that working with the DER can more effectively prepare for UNT [2].

March 16, 2012 in Astana was the historic event in the education and science of Kazakhstan - The International Consortium of developers of digital learning content for the Kazakhstan system of e-learning.

The consortium was established in accordance with the request of the Minister of Education and Science of the B.T.Zhumagulov to ensure the e-learning quality in Kazakhstan in accordance with the State Program of Education Development 2020 and the resolution of the 5th International Forum on Informatization of Education.

The task of the Consortium is to bring in Kazakhstan educational international best practices on e-learning and digital content creation. This will enable to enrich teaching methods in the subjects, almost to the achievements of the British, Poles, Romanians, Russians. With digital educational resources to learning Kazakh educational organizations will come new methods of teaching in the subjects on the basis of the latest achievements in the field of information and communicative technologies, a new paradigm of learning. However, it should be noted that there are issues that need to be resolved. Thus, the introduction of DERs in the educational process is being implemented unequally. Along with teaching staff there is actively used ICT, quite a lot of teachers who have superficial understanding of information resources and technologies, as their applications to enhance educational activities. In order to build this competence in students, the teacher himself must have information and communication competence, be able to navigate in a variety of DERs, have the opportunity to use digital educational resources for various educational tasks: motivating students, setting goals and objectives, organizing educational activities, evaluation performance, etc. I will present (part of) a fragment for the preparation of one DER and on mathematics designed for 5th grade students. Topic: "The Image of the decimal point on the coordinate ray. Comparison of decimals."

The table below shows the introduction of mathematician-author and planning and instructions to the participants-developers.

Graphics (to artists)	Theory (to speaker)	Explanations (to animator)
Stadium. In the interval with sand train athletes - two long jumper (one is Askar, the second is Dima). The long sandy area, side, marked from 0 to 9 meters as the x-axis. Each meter is divided into decimeters, but did not sign any decimeters.	Look at those long jumpers! Sports is definitely good for health. These athletes are preparing for competitions. And how do you determine who is the strongest?	Athletes wave audience. Show how they jumped both one by one.
Icon unwinding ago.	To do this, measure how far they jumped. For this we find at any of the number specified on the labeled board, landed athlete. Then compare these numbers.	Unwinding back. The icon flashes back unwinding in the top right corner. Board-coordinate axis selected and marked off.
Jumping Dima. «3m and 4dm»	Let's see how far Dima jumped. Wow! 3 meters and 4 decimeters! Well done, Dima!	Rollback icon disappears. Dima jumps. When he landed the camera closes to the mark at the feet of an athlete, and highlighted the importance of - exactly 3m 4dm.
Jumping Askar. «2m and 8dm»	Let's see how Askar jump! 2 m and 8 decimeters! So, who jumped farther?	Dima is waiting from the start with the opposite parties. Jumping Askar. Just released figures on landing at the feet of an athlete - 2m 8DM.
New background. Coordinate axis from 0 to 9m. $3м\ 4дм = 3\frac{4}{10}м = 3{,}4м$	We'll see. Dima jumped to the level of 3 meters and 4 decimeters. We write this in the form of "3 whole and four tenths of a meter"	On the left writes equations, in sync with the speaker. On the right - coordinate axis Ox. Has blue segment from 0 to 3m 4dm.
$2м\ 8дм = 2\frac{8}{10}м = 2{,}8м$	And Askar jumped 2metra and 8 detsimetrov. We write this as "2 whole and eight tenths of a meter"	Below the available the following line is $2м\ 8дм = 2\frac{8}{10}м = 2{,}8м$ synchronously with the announcer. On the same line of

		the coordinate green stands interval from 0 to 2 m 8dm.
Question.	Which of the segments are longer?	Approach to the axis. Flashing question mark.
	Blue segment is obviously longer.	Blue segment gets brighter.
New background. «3,8 > 2,8»	It turns out that the decimal number 3.8 is bigger than 2.8.	There is a record 3.8> 2.8 in sync with the speaker.
«0,7 and 0,07» «1,512 and 1,513» «5,14 and 5,41»	How to compare the decimals?	pairs of numbers randomly appear of: «0,7 and 0,07» «1,512 and 1,513» «5,14 and 5,41»
«0,7 and 0,07» «0,70 and 0,07» «070 and 007» «70 and 7» «70 > 7» «0,7 > 0,07»	To compare two decimals, it is necessary first to level the number of decimal signs, assigned to one of them zero on the right, and then throwing a comma, to compare the resulting integers.	All couples crawl to the upper right corner, but a pair of "0.7 and 0.07". Then the couple turns to a pair of "0.70 and 0.07." Disappear commas "070 and 007". Then, this fraction becomes "70 and 7." Then "and" becomes ">".
«1,512 < 1,513» «5,14 < 5,41»	You can also compare the rest of decimals!	All records disappeared. Appear «0,7 > 0,07» «1,512 < 1,513» «5,14 < 5,41»

tasks	
Graphics (to artists)	The mathematical part
1. "Given two figures, with their area. Which of the figures more? " Two arbitrary figures. And written on each area of the "33.6 m^2" and "3.36 m^2". Three options: ">", "<", "=". The window for the answer. To "grab and drag" one of the three options.	33,6> 3,36. 33,6 ? 3,36 33,60 ? 3,36 3360 ? 336 3360 > 336
2. "Stick the labels needed to coordinate axis" Coordinate axis from zero to 10. Divided into 19 parts (0.1). Sign 0, 1, 5 and 10. Downstairs in the number of tablets: 3,4; 7,0; 1,9; 8,5; 6,1; 0,3	0; 0,3; 1; 1,9; 3,4; 5; 6,1; 7; 8,5; 10.

When all this was done by joint efforts of the NCI and the SIVECO Company, DER got, the entire contents of which can beviewed on the site NIC at http://lms.nci.kz. In compiling this DER had the following objectives: to teach properly display decimals on the real axis, to form the ability to compare decimal numbers, and check the level of learning.

Animation allowed to show the process of displaying a decimal number on the real line in the dynamics (Pic.1), sound accompaniment can better absorb material (not distracted by reading) (Pic.2), game part reinforces and operates skill comparing decimal numbers (Pic.3). The interest of students to the lesson is increase. And the test allow the the student to check the level of learning.

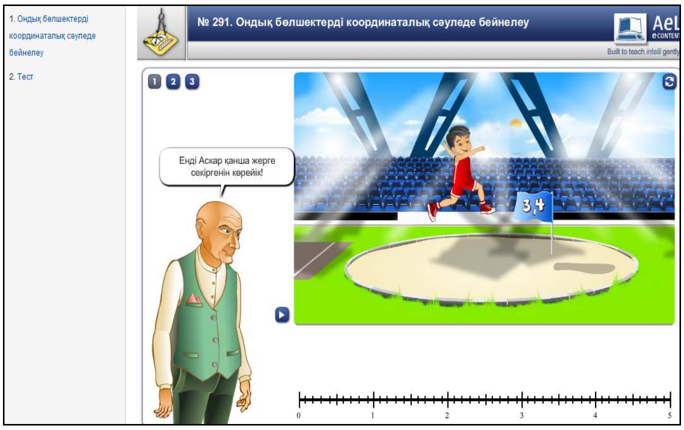

Figure 1 The initial phase of of designing DER.

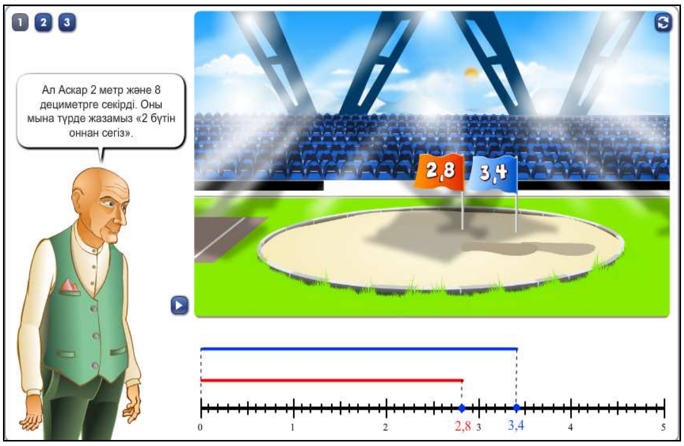

Figure 2 The process of image of decimal fractions to coordinate

Guided by principles of trust, while offering the DER to teacher complete freedom organization of educational process at their a methodical choice.

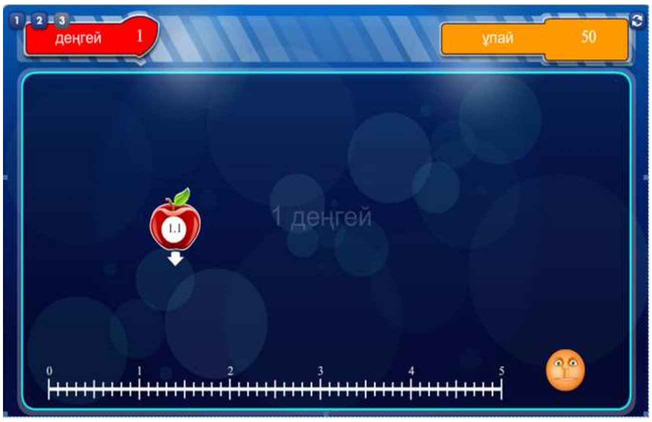

Figure 3 Game play part

In the resources development to find out that not all content lends itself to drawing up DERs. Creating a good and meaningful DERimpossible without the participation of all interested parties - the author, mathematician, methodologist, subject teachers, programmer, animator, artist, speaker, editora, financiers, managers, experts and of course the student and parent.

As is evident, touched upon only a small part of the hard work of creating DERs. Despite the lack of experience we have made a number of DERs and even in this stage, we clearly see the utility and promise of the paradigm of learning.

3. Conclusions

We would like to tell that consistent, systematic introduction to the pedagogical process of information and communicative technologies can not only expand the existing arsenal of teaching tools, but also completely change the existing forms of education. We note features the use of modern digital educational resources:

- Easily achieved level differentiation of instruction;
- Individualized learning, as each performs the task at their own pace;
- Increases the motivation of the training;
- Develops logic and creative thinking;
- Increases the independence of students in obtaining the knowledge and self-esteem;
- Increased practical orientation training;
- Provides access to a wealth of information;
- Use image-visual presentation of the material,
- Tracking errors made by students in completing assignments, and re-worked through enough learning material;
- The teacher spends less time reviewing work.

The use of DERs provide access to non-traditional sources of information, improve the efficiency of independent work of students, provide an opportunity for creativity, allows for entirely new forms and methods of teaching, facilitating efficient process of modernization of education in Kazakhstan.

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